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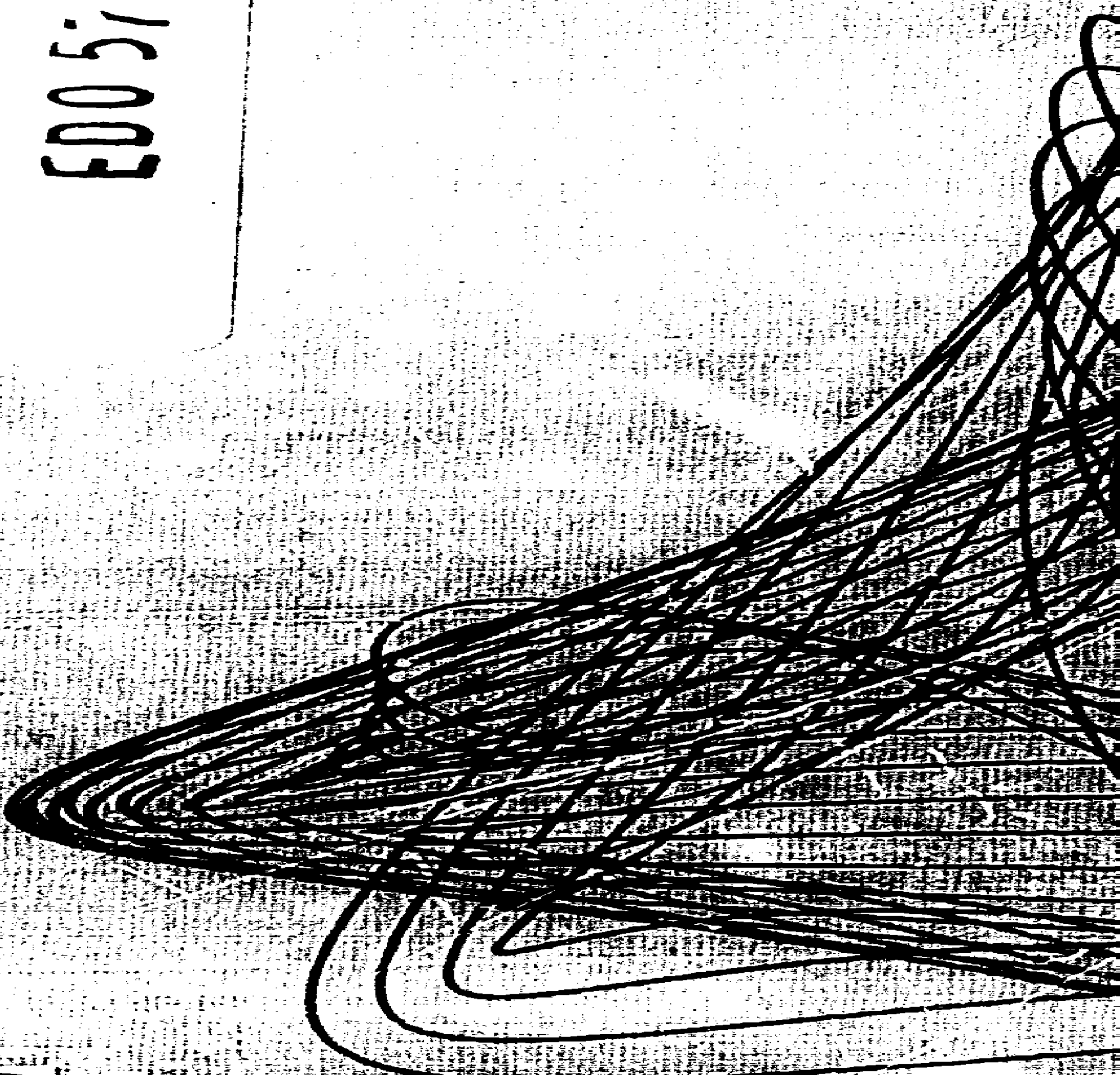
ABSTRACT

The 30th annual American Industrial Arts Association (AIAA) Convention was held in Minneapolis in 1968. Topics for the AIAA general session addresses were: (1) "A Fresh Look at Industrial Arts," (2) "New Curricular Concepts," (3) "Making Education Relevant," (4) "Industrial Arts in an Educational System for the Seventies," (5) "New Concepts in Learning and Instruction," (6) "Where Should We Be Going in Industrial Arts," (7) "New Concepts in Evaluating Student Progress," and (8) "The Interface Between Engineering and Industrial Arts." Also included are six addresses from sessions of the American Council of Industrial Arts Supervisors ar the American Council of Industrial Arts Teacher Education. ed addresses from the special interest sessions included 115 ntations concerning new concepts in industrial arts. Sample topics are: (1) "Educational Resources Information Center (ERIC) and Industrial Arts," (2) "Curriculum Concepts for Elementary School Educators, (3) Industriology--The Science of Industry," (4) "Industry and Technology for Contemporary Man," (5) "A Systems Approach for a Productive Society," (6) "Evaluation in Teacher Education," and (7) "Excellence in Teaching Through Test Analysis." (GEB)



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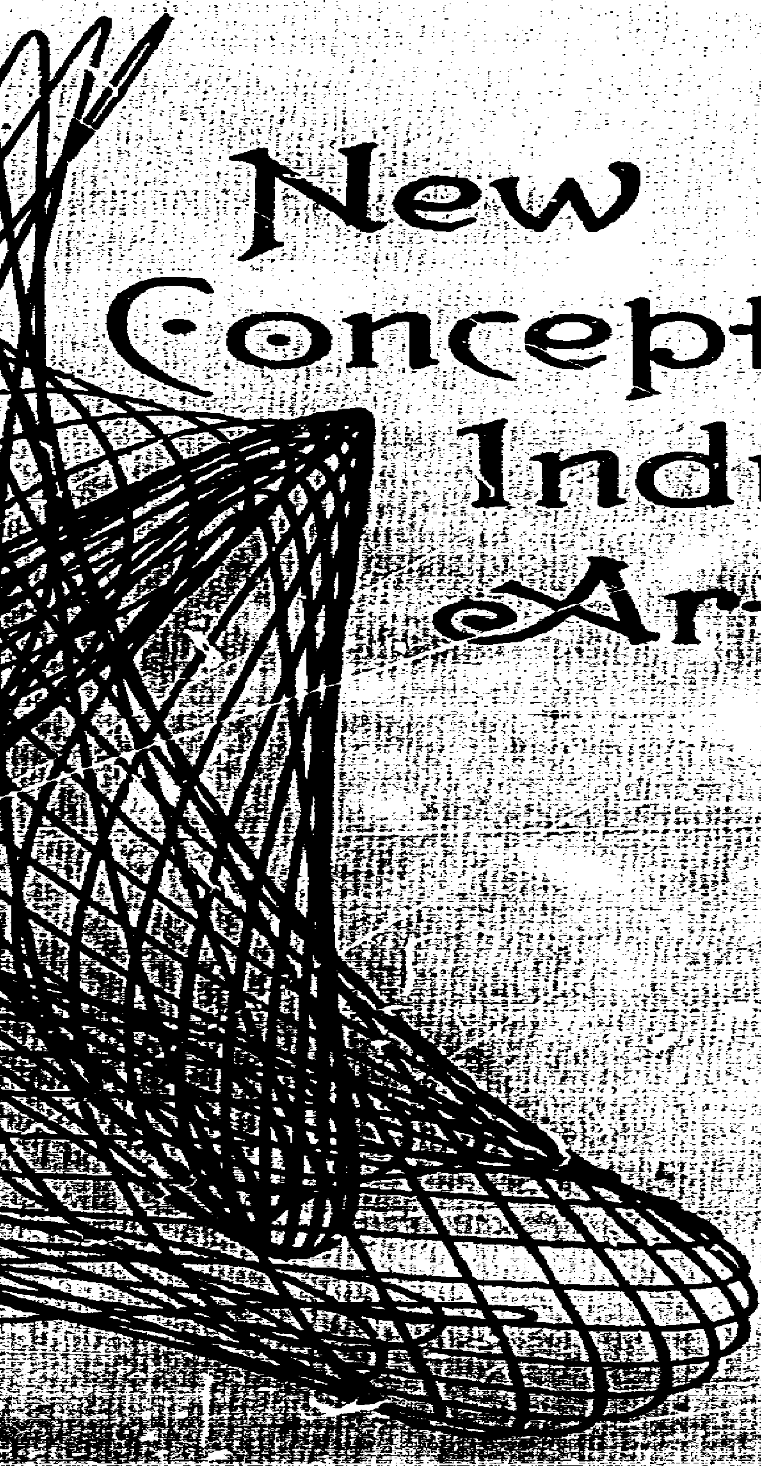
New Concepts in Industrial Arts



DINGS OF THE AMERICAN INDUSTRIAL
UAL CONVENTION AT MINNEAPOLIS

New Concepts in Industrial Arts

SELECTED ADDRESSES AND PROCEEDINGS OF THE AMERICAN INDUSTRIAL ARTS ASSOCIATION'S 30TH ANNUAL CONVENTION AT MINNEAPOLIS

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A FRESH LOOK AT INDUSTRIAL ARTS

Marshall Schmitt

This evening, I will discuss with you a paper which I have entitled "A Fresh Look at Industrial Arts". I hope to draw a verbal picture of the "state-of-the-art" – the industrial arts as I view it today.

I have organized my comments around the following topics: (1) basic premises of industrial arts; (2) significant facts; (3) major developments; (4) current problems; and (5) key concepts for industrial arts education to consider.

The latter, of course, is in keeping with the theme of your conference this week.

What are the basic premises of industrial arts education? I have often had to distill from our literature summary statements about various aspects of our profession for my work at the Office of Education. In that capacity I try to reflect the philosophy of the profession, and not my own. I find that there are two underlying beliefs that permeate our writing, our objectives and our curriculum efforts. Our profession supports the belief that when industrial arts is taught properly, it can develop an understanding of this pervasive force we call industry and technology, and it can discover and develop the creative technological talents of human beings. These two fundamental beliefs appear to be the pillars upon which our program of industrial arts rests.

Our educational system, as an institution, must accomplish three things. First, it must transmit to the young what its scientific-technological society is like, its values, its beliefs and its mores. Second, it must meet the needs of the individuals under its care, and, third, it must build within the society a mechanism to re-create the society so it will grow in the direction of a better life for its citizens. The beliefs about industrial arts mesh inextricably with these basic purposes of education. Therefore, it is necessary for all who live in a technological society to acquire an understanding of industrial arts through the systematic study of the subject matter.

From the two major thrusts of the program, specific objectives can be identified which relate to the various levels of instruction. When one has acquired some knowledge and understanding of the industrial arts from taking well-organized courses, his behavior should change in wholesome ways. Let me cite just a few examples:

One of the most important is the change of attitude and understanding about industry and technology, and the realization that this pervasive force has the capacity to raise man to greater heights or to destroy him by the misuse of technology – or of the arts of industry.

In industrial arts, a value often overlooked is that of making wise choices in the purchase of the products of industry and technology. Making a wise choice from an almost endless array of similar products which purport to achieve the same function but have different prices is no small task. Experiences in a good industrial arts program provide you with knowledge and information you can put to good use when making choices, for example, of an automobile, suit of clothes or tape recorder. The consumer value of the industrial arts is an important aspect of economic education, because, when higher-quality, rather than low-quality, goods are purchased, the latter, for want of a buyer, will soon disappear from the marketplace, unwanted and unused.

Another value of industrial arts education is that it helps students to make career choices. When industrial arts is taught properly, the broad spectrum of skills, knowledge, understanding and attitudes learned by the student is directly applicable to most occupations and professions. For example, the design of a suburban dwelling in an architectural drawing class helps the 11th- or 12th-grade student who wishes to be an architect attain a "running start" in his profession. This kind of experience helps any student evaluate

his future home, whether he wishes to be an architect or a factory worker.

Moreover, as a society grows more complex and provides man with more leisure, he needs to look for another outlet for his creative energy. The industrial arts provide him with this opportunity to interact in meaningful ways with all types of materials in order to create new technical things which in part contain a little of his personality.

It seems to me that industrial arts activities provide still another route for students to learn. I call this the non-verbal route to verbalism. I think sometimes we in the profession do not realize the power of our own program as a learning vehicle for youngsters. It seems to me that the modern industrial arts program captures much of the learning theory and philosophy of such men as Pestolozzi, Rousseau, Locke, Dewey and Montessori and puts it into a modern-day educational setting.

Let me now highlight some of the data to which we can refer as the status of industrial arts. I consider the status at this juncture of history, for example, as a ten-year period centering in the 1960's. In discussing the status of industrial arts, I must include my work at the Office of Education, because the Office has had a major task in determining some of the basic facts and information dealing with industrial arts education.

I am the fifth specialist the Office of Education has had in industrial arts education. When I came to the Office in 1957, we had one publication dealing with industrial arts education. That publication, entitled Industrial Arts—Its Interpretation in American Schools, was published in 1937, twenty years earlier. To me, the major problem facing our profession at the national level was the lack of adequate data to determine the various characteristics and parameters of industrial arts education. Without this information, I soon learned you could not make reliable projections to improve or even to discuss the program in terms of national needs. Hence, I was constantly bombarded with the question, "What are the facts?" So, I set a course to gather them as rapidly as possible. Basically, I sought the answers to three questions: (1) What is the recommended instructional program in industrial arts? (2) To what extent does this program exist in the public schools? and (3) What were the major problems or issues in industrial arts?

The answers I found to these questions are supplied in my publications from the Office. For example, the bulletin entitled Industrial Arts—An Analysis of 39 States' Curriculum Guides gave considerable insight into our instructional program. In fact, the technique used in the analysis bared our program to the bones, and some people didn't like what the study revealed. Some people thought I was recommending this program. All I did was to document what you wrote about what the program should be.

One person wrote me saying he didn't like what he saw and suggesting that I throw away everything except three pages. The three pages contained only my suggestions as to what should be done to improve the program. However, if a very critical review were to be made of that study, you could see some of the major classifications of content emerging today as something new. Many of these are not new, and we have been teaching a great deal of what is now considered the "new look" in industrial arts. I subscribe to a comment made by one of our leaders, who said, "As we improve or clean up our program, let's not throw out the baby with the bath water." We certainly need to discard content that is unworthy, but let's not jump into a program that has a different label until we know whether it is better than what it is to replace.

The publication entitled Industrial Arts Education—A Survey of Programs, Teachers, Students and Curriculum supplied some answers to the question of what is actually taught in industrial arts. A statement I made in the publication reads: "The current industrial arts curriculum does not even measure up to the program recommended by the profession 10 to 20 years ago." In this regard we are no better than the other subject fields in the public secondary schools. For example, the new math, new science and new social studies programs grew out of similar concerns to improve. Likewise, our industrial arts programs are undergoing change. These efforts suggest new structures which would reorganize the instructional content to reflect the technology around the emerging subject areas of manufacturing, construction, electricity/electronics, transportation and others. But it will take massive efforts before any new industrial arts curriculum, or any other new approach to teaching the industrial arts, can make much of an impact on the current program and eventually improve the technological literacy of the American public.

The statistical study also provided some significant facts which can serve as points of departure in improving the industrial arts program in the US. Let me enumerate several of these:

Three-quarters of the American public secondary schools have industrial arts programs. If a detailed analysis of the schools which do not have industrial arts were made,

you would find that most of these are small (i.e., under 300 pupils).

There are over 40,000 industrial arts teachers in the nation's public schools, grades seven through 12.

The average industrial arts teacher's salary is $6,200 per annum, plus what he earns in a non-teaching or second teaching job.

Most teachers teach from curriculum guides which they themselves prepare. This fact has many implications for teacher education and for future institute programs.

Nearly 40% of the teachers made significant changes in their courses, such as, the introduction of new instructional areas to broaden the content, the addition of new courses to meet the needs of upper-ability students, and the development of close relationships with science instruction. It appears that many of our teachers are already on the road to improvement.

One of the most significant problems teachers encounter is keeping up with advances in technology. Of all the problems reported, this headed the list. The institute programs are helping solve this major problem; however, we are barely scratching the surface compared to the need.

There are over four million student enrollments in industrial arts courses in grades seven through 12.

One of the most interesting facts uncovered by the survey was the trend to increase somewhat the compulsory school requirements of industrial arts for both boys and girls.

Many other facts could be cited from the study, especially if you "mine" the data, as one of my OE colleagues used to say. For example, if you look closely at the background of industrial arts teachers, you will find that their preparation in science and mathematics does not increase, no matter how much further education they may acquire. This one bit of information has, I believe, a great deal of significance for our teacher education departments and for the development of future institutes for industrial arts teachers.

Let me leave the national statistical survey data for the time being and discuss another publication entitled Improving Industrial Arts Teaching. This publication has been widely distributed to and accepted by the profession. It is, as many of you know, the USOE Conference Report on Industrial Arts, released in 1962, and now in its third printing by the Government Printing Office.

One of the reasons for this publication's great success is that it was the result of a cooperative effort, whereby I had the opportunity to contact many leaders in the US who, in turn, helped me identify the main problems and issues and select the individuals who wrote the conference papers. Lee Hornbake's paper, "The Place of Industrial Arts in the American Culture", and Ivan Hostetler's succinct restatement of the objectives, along with other significant papers, have had a major role in determining the future direction and in clarifying the role of industrial arts in American education. I make this statement because so many of the newer state curriculum guides, definitions and national groups are using this information as the basis and/or reference for improving their programs throughout the nation.

The three publications I have mentioned have been helpful in filling the gap of national information on our curriculum program, and this function has been one of the historic roles of the USOE, and of its chief instrument, the Office of the Specialist for Industrial Arts.

I have also experienced the changing role of the OE itself, caused in part by new federal legislation for education; hence, I, too, have had a broadening experience. Because of the new legislative programs now administered by the Office, the various specialists have, at times, been afforded the opportunity to assist in their implementation. Some of the programs have made it possible to accelerate the improvement process for industrial arts education. For example, the Cooperative Research Act, the National Defense Education Act, the Elementary and Secondary Education Act and the Higher Education Acts have all made their impact on industrial arts education – in research, in equipment, in institutes and in buildings. These federal programs have made it possible for you in the field to submit proposals for action. To the extent that you make use of the funding approach, industrial arts will, no doubt, improve in many ways. The effort must be made.

As I view the industrial arts field today, I can see several major developments affecting the program significantly in the immediate future.

The first major development is the fact-gathering phase, or the description and identification of the parameters of our program on a national scale. The data published by the USOE give us a point of departure and a framework within which to make projections

for improvement. For example, my estimates indicate that it would take $641 million to bring the industrial arts program up to the curriculum standards recommended by our professional groups. Yes, $641 million – a very conservative figure that does not take into consideration the newer programs and their special needs.

The second major development is the emphasis on major curriculum efforts. I believe we will look upon the period after World War II as the period in which the industrial arts profession clarified its thinking regarding the source of curriculum content and made us aware of the magnitude of the task to determine the structure of the discipline from which we draw our content. When we have men like Paul DeVore, who will take off on a European trip at his own expense and devote his energies to the study of man's technical endeavors, which, from his analysis, appear to have external stability and internal flexibility, then we will formulate this body of content from which we can draw our subject matter. I could name others also engaged in the major task of classifying content, identifying teaching strategies, designing physical facilities and creating new teacher education programs. The federal government has made much of this possible through research grants from the Cooperative Research programs.

The third major development is the creation of the Executive Secretary's office in Washington, DC. Here several individuals are devoting their energies toward improving the quality of instruction in the nation's industrial arts programs. To be sure, other national organizations and state groups certainly play their important roles, but never before could we, as a profession, claim so many individuals whose entire time is devoted to a professional organization. As a result, we now communicate our purposes better, and we document our thinking in brochures, guides – in short, our program is better understood today than in any other period.

The fourth major development is the terminology study. As many of you know, there has been a problem in American education regarding the ready collection, combination and communication of meaningful information about the subject matter offered in instructional programs. The Office of Education has for several years been working with various groups to develop standard terminology of instruction for local and state school systems. As a profession, we had been struggling, too, to clarify our terms, and this organization, along with others, has been helpful in solving the problem. As a result, industrial arts is one of the major subject areas included in a forthcoming document on definitions. I might add that "determining definitions" is no small task, and any resulting publications must be continuously reviewed and updated. Again this effort relates to clarifying our role and the parameters within which we operate.

The fifth major development is the national evaluation program being developed by the profession in conjunction with the Educational Testing Service at Princeton, NJ. The first of this series of standardized achievement tests will be available either in late 1969 or early 1970, and will be directed at the junior high school level. Much effort has already gone into the development of these measuring instruments, which will provide, for the first time, valid data on how well our students are acquiring knowledge about the industrial arts. As our evaluation efforts continue, the next emphasis will be on our senior high school curriculum, then, in future years, the elementary school. This evaluation effort is not a "one-shot deal". It is envisioned as being a continuous updating process. For the first time, we will begin to acquire a measure of the technological literacy level of the American student.

The sixth major development is on the international scene. There is an increasing awareness of industrial arts education as a vehicle to develop an understanding of this pervasive force we call technology. As many of you know, I had the personal experience, as a representative on a government team, to observe Soviet education, in particular, poly-technical education. The report entitled Soviet Education Programs, as well as some of my other writings, provides a detailed account of this program. At the time of my visit, the Soviets were making comparisons with other foreign programs which dealt with technology. Since that time, there has been a growing interest in industrial arts and the methods which purport to acquire this knowledge.

Some of the points of emphasis gleaned from our program by individuals in other countries include: Developing an understanding of technology; aiding the learning process by providing for direct student environment and feedback; developing an appreciation for work; encouraging study of economic education (production and consumption of goods and services); and providing the vehicle to integrate subject matter. Of particular interest is the general shop idea. In fact, I am of the opinion that the concept of the modern general shop is uniquely American and is a contribution of industrial arts to American education.

Some of the countries having a particular interest in the industrial arts program at the present time include Germany, Sweden, England, Australia, Canada, Jordan, the Soviet Union, Japan and Brazil.

The seventh major development is in the area of state supervision. When I came to the USOE in 1957, we had ten state supervisors. A fresh look reveals that now we have 31 state supervisors, and we expect to acquire another on July first. This fact speaks louder than anything I can say about the state of our profession today.

Let me leave the current developments and identify some problems with which we as a profession will need to come to grips and for which we will need to find satisfactory solutions.

First is the shortage of teachers. Just recently I reviewed Denis J. Foley's investigation of current practices for influencing students to prepare for industrial arts teaching. (This study was completed at New York State University.) He provides some suggestions for action, such as, coordinating national efforts, counseling students in college, encouraging students in high schools to prepare for industrial arts careers, and others.

The second major problem is the clarification of our major goals for the American public, Congress and the educational community. We have improved in this area in the last few years, particularly through our publishing efforts. The councils have been instrumental in bringing this about, as have our various executive secretaries. But we still have a long way to go, especially at the local school administrative level. We need to state our goals clearly, to make our program of such high quality that even the use of outside money will not influence the selection of one program over another.

The third major problem is to tap additional funds for program improvement. Although we have made progress in the use of some federal funds – especially in the institute program, and in research and equipment under the National Defense Education Act, as amended – much more could be done. For example, we could more effectively tap the source of funds in Title III of ESEA, known as PACE (Programs to Advance Creativity in Education), as well as private sources.

Using additional sources for funds provides more manpower to improve at an accelerated rate. Some of our leaders have done an admirable job in this regard and have helped the profession considerably, particularly in research. But our task is so great, we must coordinate our efforts on long-term cooperative undertakings.

I could go on listing other problems, such as methods, updating of content and facilities, but the above seem to me to be the important overriding problems.

Before I move on to another topic, I want to mention an issue that I find myself discussing from time to time. This is in the area of skill development. It seems to me that skill development (manipulative and mental) is an important aspect of any program. To illustrate from another field: If a student wishes to communicate an idea through a written essay, he must be able to write legibly and think clearly. It would be a goal of the student to learn to write legibly in order to communicate his ideas effectively in the essay. But we would not expect him to write it in Old English, such as one finds in the lettering on a diploma.

Similarly, in industrial arts work we expect students to do high-quality work commensurate with their ability levels to do what the task requires. We expect them to develop pride in their work and an appreciation of craftsmanship. For example, if a student wishes to become a General Class radio amateur, he will need to develop the skill to send and receive 13 words per minute. However, if he wishes to have an Extra Class license, he will need to send and receive 20 words per minute, in addition to having a much deeper knowledge of electronics and the ability to apply its principles in radio.

The point to which I am leading up is that the goal of the student, especially at the senior high school level, is a determining factor, and a good industrial arts teacher will, I believe, allow and encourage the student to plumb the depths to identify and establish that goal. This goal-seeking effort may or may not have relevance to an occupational goal. It may be entirely recreational. Becoming an amateur radio operator is a good example. A golf-playing friend of mine is a lawyer – but his hobby is amateur radio work. He has extreme depth in electronics, and this work provides a balance in his life and an area of creative outlet in a field almost exactly opposite to the one in which he is professionally engaged. Therefore, depth in a field of knowledge is a major goal of industrial arts and is a human development goal. As a person seeks depth in a field of inquiry for its intrinsic value, he will find also that depth of study brings breadth of understanding, because as you dig deeply you get to the heart of the matter and begin to see the interrelationships, the totality of all things.

Now, what about the future of industrial arts? It seems to me that all of us are struggling to determine the best future for our program. I do not, however, feel that any one person or group has the key. Probably the program that will emerge will be the one that best meets our stated goals and needs of our youngsters. However, I do feel that we should consider in the future the following main themes – understandings to which industrial arts can contribute in a major way, or in a way different from that of any other subject field in its approach to helping students formulate their own understanding. In keeping with the theme of your conference, you could call these themes "key concepts" to consider for industrial arts education.

The concepts are not mutually exclusive; in fact, some will reinforce others in their development. However, I feel they permeate our entire field, from kindergarten through the college and adult levels. A person should grow in depth of understanding of each concept as he matures. At this time, I will present twelve concepts. I hope they will provide you with some new thoughts.

The first concept relates to societal needs: Industry makes use of knowledge through industrial organization and the management of the resources to meet the needs and wants of society. For example, individuals need to be transported, housed and fed, and require various kinds of services. In the early days, man used one of the most abundant of materials – wood – and used the knowledge he had of it to meet his needs and desires. Various industries grew up around this basic material, which was modified to increase its value. Other common materials were used, too. The schools reflected this in courses such as woods, metals, and so on. However, a fresh look at industry today reveals, as John Kenneth Galbraith reports in his book The New Industrial State, a structure which is far more complicated and interrelated than in the past. New approaches to understanding the key concept are now needed, and, as many of you know, new courses are emerging, such as manufacturing, construction, research and development, industrial materials, and more. These courses reflect the changes and their complexities.

The second concept deals with human resources: Human energy in the form of work (physical and mental) is the creator of the material culture. It seems to me that industrial arts is another area of human experience in which man creates – however, in industrial arts, man is creative in a "technological", rather than in an "artistic", sense. Both are interwoven in the complexity of the experience. It is the useful and man-made world that is our primary domain.

The third concept deals with technological change: Advances in the material culture are accelerated through the arts of industry. This concept is related to economic efficiency. It is the struggle for better quality, for more functional goods and services and for reduced costs that spurs industry forward. I often recall a motto that reflects this continuous change. It was hanging prominently from the ceiling in several areas of a large industrial plant I visited several years ago, and stated: "There's always a better way."

The fourth concept relates to emotional stress: Changes in the material culture have positive and negative effects on humans. Since technological change is rapid, it often does away with traditional ways of doing things, ways people know and with which they feel comfortable. Many of these new ways have side-effects which are detrimental to human growth and development. Children should be educated for change so that it is not new to them. Those of us who have experimented with the mass production experience in industrial arts know of the frustrations it can cause. However, under the proper supervision, this learning experience is extremely important in many different ways and, I believe, contributes greatly toward students' getting used to change by experiencing a continuous developmental type of activity.

The fifth concept deals with safety consciousness: Each tool and/or machine has the potential to do useful work for man or to do injury to him if not used properly. This concept, of course, is in the realm of attitudes and habits. Industrial arts activities which include safety instruction contribute toward developing this concept. It can be taught at any grade level and should carry over into adult life.

The sixth concept deals with man's domination over machines: Tools and machines extend man's control over his environment. Students need to understand tools and machines and to learn to control them, whether the tool is a small chisel or a large computer. Student involvement in the actual use of various types of tools helps develop this concept.

The seventh concept deals with the dignity of work: It is through human effort that man achieves his goals. Actual student involvement in the various industrial arts activities shows the need to do small manipulative tasks, as well as high-level mental tasks, to

accomplish a worthwhile goal. All tasks are important in achieving the goal; otherwise the goal could not be won. The proper attitude toward work is essential to our well-being.

The eighth concept is related to man's limitations: Technology can overcome some of man's limitations; the limits of man's modern technology stimulate the desire for more rapid change. Probably the most outstanding example of the use of modern technology is the space field. Here modern technology can build a space suit which allows man to live in an otherwise detrimental environment. Through modern technology, the environment can be altered, and a man can be protected against its hostile forces. The modern computer is even challenging "thinking processes" with its ability to make decisions. Nevertheless, it seems that no matter how sophisticated modern technology can become, there is still a better way on the horizon, still "new worlds to investigate". Modern technology stretches man's imagination more now than ever before.

The ninth concept deals with consumer values: Man needs knowledge about goods and services to judge quality. A person can make intelligent judgments only upon what he knows. If, through industrial arts experiences, a person can acquire, for example, the knowledge and experience that go with applying a high-quality finish on wood, this person is better able to judge the quality of finish on other wood furniture he or she may purchase for home use. Many examples could be cited, and, as I mentioned previously, this aspect of the industrial arts is actually a form of economic education.

The tenth concept is related to tools, machines and processes: Advanced tools and machines make use of the basic ideas of the fundamental tools and machines, but in new and interrelated ways. Understanding these fundamental tools and machines provides insight into the more complicated processes. This information is fundamental to understanding advanced technology. Even the most complicated satellite uses the principles of the basic tools and machines. A student who has designed and built a remote control robot has already acquired the basic knowledge to understand how a satellite command system operates. The transfer of understanding from the industrial arts lab into the real world is made much easier by these experiences.

The eleventh concept relates to recreation: Manipulating and creating things with one's own hands bring out human qualities. We actually know very little about the interrelationship between the physical act of doing something and the emotional and cognitive reactions of human beings to these self-directed acts. One thing is sure, however — whatever occurs is complicated but can have very desirable results. For these reasons industrial arts activities are often used with handicapped children. The results of some current research with students of all ability levels give positive evidence that industrial arts instruction increases academic achievement and the development of desirable attitudes.

The twelfth and last concept relates to societal direction: Technology can help man achieve his goals, but technology should not determine man's goals. Therefore, all individuals must understand the arts of industry which create the technology, in order to direct that technology toward socially useful goals. The power available to man through his advanced technology is awesome. If used improperly, it can destroy us, as pictured in Neville Shute's book On the Beach. Hence, industrial arts teachers are engaged in one of the most important tasks — that of providing new meaning for this concept by actively engaging students in the creation and control of their environment. The industrial arts can open new horizons upon which man can apply his intellect.

Now that I have presented some thoughts about the basic premises of industrial arts, cited some significant facts, highlighted several major developments, considered some current problems and presented some key concepts for you to consider, what can I conclude about the state of the industrial arts profession today?

My previous remarks attest to the fact that we have already come a long way in the last ten years, and I believe we have the momentun to continue to even greater heights, especially if we see industrial arts education as a curriculum area for all students. When we do this, industrial arts will reflect the forward-looking thinking of the industrial arts profession.

I believe we will build from our present structure of industrial arts and broaden its offerings to reflect man's technological effort to improve his life and to control and modify his environment to meet his needs. Even the name of industrial arts reflects this interrelationship. The term industrial means industry and technology; the term arts, creativity in man. Together, the terms suggest that man is using his creative ability to modify materials technologically to increase their value in meeting his needs and wants. I believe a good industrial arts education program will reflect this interaction of man's control over his environment, and I believe industrial arts can be as viable and as dynamic as

man in his efforts to create language and mathematics, or to discover scientific truths.

I hope that my "Fresh Look at Industrial Arts" this evening will provide you with a glimpse into an exciting future which will challenge us as we seek to improve our program in order to provide a better education for all our citizens.

Dr. Schmitt is an Industrial Arts Specialist with the US Office of Education, Department of Health, Education and Welfare, Washington, DC.

W-6.0 AIAA
Second General Session
NEW CONCEPTS IN CURRICULUM DEVELOPMENT
Presiding, Ralph C. Bohn; Greetings, Dr. John B. Davis; Introduction, Robert L. Woodward; Speaker, Kevin Ryan; Rec., Howard Wicker; Hosts, Edward D. Buchholz, Charles H. Magedanz, Gary D. Kroak, Floyd L. Jack.

NEW CURRICULAR CONCEPTS

Kevin Ryan

America in the late 1960's is experiencing a profound and wrenching social upheaval. We are fighting an ugly and confusing war on the other side of the earth, which has divided our nation at home. Deep-seated racial tensions have come to the surface. Social injustices have been exposed. Authority and leadership at all levels from the President to the parent are being challenged and often rejected. The economic policies of the richest nation in the world are beginning to feel stresses and strains. Our giant industrial capacity is turning in on us and fouling our lakes and skies. Our cities rot. Our suburbs sprawl. Our farms are being turned over to machines. And, further, we are undergoing a revolution in national morality. There are new ground rules and attitudes towards work, the family, drugs and sexual bahavior.

This national upheaval has not left the schools untouched. The turbulence that is threatening so many segments of our culture is also threatening the schools, the place where children systematically learn about the culture. At present a watershed of discontent over the schools is building up. Students at both ends of the intellectual spectrum are tuning out and dropping out. Both the gifted and the below average are finding the schools irrelevant to their needs. While the non-academic students literally drop out of school, the intellectually gifted normally stay in high school on the usually unfilled hope that things will be better in college. Teachers, too, are dissatisfied with a whole range of issues, from their low salaries to their lack of a voice in policymaking. Many parents, too, seem to have acquired an almost neurotic faith in the power of the schools. Convinced that the schools are the key to the success of their children, parents are becoming an increasingly vocal pressure group. Of special concern are the schools of the cities. Large city systems are often unresponsive to the needs of local community people. City dwellers, rich and poor, are realizing that quality education is not possible, given the slim operating budgets of most big city systems.

Much of the recent dissatisfaction is reflected in the works of the new breed of critics. There has been a great change here in ten years. A decade ago the Rickovers and Conants were faulting the schools because they lacked sufficient intellectual rigor. The new critics, such as Edgar Friedenberg in Coming of Age in America, Jonathan Kozol in Death at an Early Age, Herbert Kohl in Thirty-Six Children and others, are telling us that the school is dehumanizing. They claim the schools are rigid, authoritarian, overregimented and hopelessly boring.

What all this indicates to me is that the society and the schools are in deep trouble. We are not in a time for stability or entrenchment. This is not a time for satisfaction. We educators, teachers and administrators, should all be involved in the fundamental examination of the schools. We should be asking ourselves what the schools should be doing to benefit the individual and, by this means, to benefit the total society. "What the schools should be doing" is, of course, a curricular question.

When I took on this assignment to speak on "New Curricular Concepts" I started doing some homework. What I soon rediscovered is that the word "curriculum" is perhaps the most hard-to-pin-down and slippery word in education. It seemed that every writer I encountered had his own definition and his own interpretation of the term "curriculum". At the one extreme there were those for whom curriculum meant a particular course of study in a particular discipline or field of inquiry. At the other extreme there were those who use the term to encompass "all learning experiences children have under the direction of the school."

However, by looking at the questions which are asked in the name of curriculum, one gets a sense of its scope. "What should we teach?" – the questions of content. "How shall we teach?" – which encompasses methods and strategies of teaching. "Why do we teach?" – which probes the goals of instruction. "How do we know when we have taught?" – which leads us into evaluation. "When shall we teach?" – the questions of grade placement of students and sequence of material. "Who will teach?" – directing us to the school personnel. "Whom will we teach?" – which refers to our clients, the students. These are but a few of the questions and issues raised by the term "curriculum".

As I approached the task of setting before you some new curricular concepts, I was reminded of James Thurber's opening sentence in a review of a very learned and erudite book on penguins. Thurber stated, "I learned more about penguins from this book than I wished to know." With that in mind, I decided that instead of providing you with a long bird-seed catalog of the new and innovative in curriculum, I would present some thoughts on three curricular questions which, hopefully, will facilitate your own discussions of the industrial arts curriculum. The questions are, "What should the schools teach?", "How shall we teach?", and "Who teaches?". This last question deals with the place of new technological advances in the schools.

New Curricula

Perhaps the most striking example of new curricular ideas is in the recent curriculum projects in the disciplines. Hosts of discipline-based curriculum materials such as BSCS, SMSG, PSSC, ESS, CBA and UICSM have come into our schools. Some refer to this as the alphabet-soup invasion of the American schools. Although scholars argue about how all this got started, most agree that the great impetus for the new discipline-centered curriculum reforms came from the Russians' dramatic push into the Space Age with Sputnik. Spurred on by federal funds and by public dissatisfaction with the state of our school curriculum, scholars in the sciences, mathematics and the humanities leaped into what they perceived as the subject-matter vacuum of our schools. The key word in their endeavor is "structure". These new curriculum builders sought out the major structural elements of their disciplines. The resulting curricula are built so that students seek out the key ideas, concepts and organizing principles of each discipline. The major intent is to get students of a discipline – say, mathematics – to think about a problem the way the scholars in the discipline attack it.

The new curricular projects emphasize equipping the students with the intellectual skills to attack new problems and seek new relationships. The move here is away from memorizing facts and formulae. From one perspective the university-based scientists and scholars who built these curricula sound very much like progressive educators of the 1930's. "Learning how to learn" would appear to be the rallying cry of both movements.

It would be quite presumptuous to offer an evaluation of these new curricular projects at this time. First, such an evaluation is beyond my capabilities. Second, and more important, these new curricular projects are simply too recent for any definitive evaluation. While it is difficult to evaluate their educational value, there seems to be little doubt that these curricular projects will be with us for several years. Each fresh project comes to the schools wrapped in and decorated with the praise of renowned scholars and scientists. Also, the projects are being propelled by the muscle of the various publishing houses. Third, the projects have the support of parents. What parent would dare fight the adoption of "the new physics" if it meant lessening his son's chance of getting into college?

My slight cynicism arises from the easy victory of these new curricular projects. The immediate predecessors of these courses, like "old physics" and "old biology", were obviously found wanting. They were dull. They were boring. We are told they were filled with a lot of unnecessary information. They never seemed to get around to the essentials. However, instead of questioning whether or not we should have the subject in the curriculum at all, we are making a great fanfare in welcoming back these previously

disappointing disciplines. It seems to me we should be asking a prior question, "why do we want this subject in the curriculum in the first place?"

Let me approach this issue from another direction. We have a conflict in education that seems to be getting deeper all the time. On the one hand we have a crowded school day and school year. Most teachers and most students are quite busy with the traditional subjects. On the other hand we are told by people like Marshall McLuhan that schools are irrelevant to the world in which children must live, and that children interrupt their education when they go to school. We also see efforts on the part of many to develop curricula for entirely new subjects. For example: sex education, communications, computer science, anthropology, ethics and morality and human relations. The question that this conflict and the challenge that these new curricula raise is the primary question, "what should the schools teach?" Although this is an old question, I think we can expect it to be raised again with a new urgency. It will be asked for several reasons. First, the total school curriculum is already crowded. We can only teach a small slice of mankind's knowledge. We will have to make choices. Second, schooling is becoming increasingly expensive and the burdened taxpayer will demand rational answers to such questions. Third, people are becoming increasingly concerned with what men need to know to live in the twenty-first century. It may be that the way we presently are slicing the curriculum pie is totally inadequate for tomorrow and perhaps even for today.

In the past when asked why we taught this or that subject in the curriculum, we were able to get away with such answers as "why, every educated man should speak French." "The colleges expect students to have studied at least three Shakespearian plays." "We've always taught X." "My subject, Y, has an intrinsic beauty and all students should be exposed to it." These answers may have sufficed in simpler times, but they are out of place today and they will not be tolerated tomorrow.

We noted earlier that the new curricular projects in the disciplines are characterized by a shift in emphasis from information to intellectual skills, from product to process. A parallel change, and one of perhaps even greater importance, is taking place in methods of teaching. A dozen years ago when I was in the Navy I was sent off to instructor school. The school was supposed to make me a teacher in two weeks. In essence, it was a cook book course, but not a bad one at that. When we came to principles of instruction, the tough, gnarled chief petty officer who was our instructor said, "Der is nuttin' to dis teaching. All ya gotta do is remember one scientific principle. Tell 'em what ya gonna tell 'em. Tell 'em. And tell 'em what ya told 'em." In many ways this is one of the most helpful things that I was ever told about teaching. However, it is hardly all of teaching. While it worked well in the Navy with a captive audience, it worked less well in the public schools where I had a semi-captive audience. Also, it was hardly the all-inclusive principle that I had been led to believe it was. To tell 'em what ya gonna tell 'em, tell 'em, and tell 'em what ya told 'em works some of the time for some of the people. What I discovered, and what most other teachers have discovered, is that while teachers may talk, students don't necessarily learn. Learning is something that goes on within the head of the student. It is an individual activity, an individual thing.

The new teaching methodologies, then, which are just beginning to take shape, are in direct reaction to this principle of teaching by telling students. I don't think that the profession – the teachers, the researchers, the writers – have settled on one term for this methodological approach. Perhaps we will discover that there are several different approaches here. However, right now there seem to be several terms for essentially the same approach. Some call it discovery teaching. Some call it heuristic teaching. Some call it inquiry teaching. In essence, this shift is from the teacher to the learner. Its purpose is to get the student involved in his own learning by challenging his curiosity, by presenting him with solvable problems, by providing him with the time and resources to investigate and discover on his own. This may sound as if the teacher's role will be made easier. I doubt it. I think it is true that most of us find it a great deal easier to tell people things than to stand back and watch them grope with questions and problems.

It is not at all clear that the discovery approach is the most efficient way to have many students learn information or acquire skills. However, if we see the role of the school as teaching children how to learn, assisting them in their quest for a satisfying life style, and preparing them to deal continually with a changing society, then the true importance of this teaching methodology becomes apparent.

<u>Mastery Learning</u>

About a dozen years ago, after an unsuccessful campaign for the Presidency, Adlai

Stevenson remarked, "Something happened to me on the way to the White House." The same could be said about schools. Something has happened to American education on its way to fulfilling its high purpose. We have built an impressive school system to do some very important things, but somewhere along the line we have become diverted. Most of us would agree that the primary purpose of education is to serve the individual. The end of education is to make a person free and autonomous, to help him be creative, and to aid him in the development of true self-respect. The curriculum is the means to achieving these noble ends. We have drawn upon the universe of knowledge and skills to help us. From this we have formed courses of study in English, in social studies, in mathematics, in industrial arts and in foreign languages. These subjects are the means we use to help students achieve the ends of autonomy and self-respect. But somewhere along the way something happened. The subjects have become ends in themselves. The individual student becomes subservient to the subject and frequently the subject becomes a real block to such things as creativity and personal freedom.

Perhaps I can illustrate this best by offering a personal example. Ten years ago when I started teaching English, I was in full agreement with the aims of education stated above. I thought one way of achieving some of these objectives would be to have students gain a knowledge and a command over words. Therefore, I set forth certain vocabulary words that my tenth graders were to learn. Every month they were to learn a hundred words drawn from the literature we were studying. We went over these words in class. The students wrote homework assignments using the words. Finally, at the end of each month we had our vocabulary test. As can be expected, some students did very well on these tests, getting A's. Some less able students got B's and C's. And then there were those who received D's or even failed. These grades went into the book and then we went on to another set of a hundred words and the process was repeated.

I present this not because it represents anything very startling. Just the opposite. This is the normal procedure followed by teachers. We set out work to be learned, we provide opportunities for students to learn and then we grade them on how well we have done. What happened in my class happens in most other classrooms. The curriculum becomes a source of success for a few and a source of failure for others. My C, D and F students learned some vocabulary words. They also learned some other things. They learned there were a lot of words they didn't know. They learned that they were not measuring up to the teacher's standards. They probably learned that they weren't very bright, but they probably had been learning that for the preceding nine years. For a good portion of the students the curriculum became an agent of psychological punishment. It is difficult to have much self-pride if you are continually being told of your inadequacies. In other words, the implementation of the curriculum often works against the ends of the school.

There is a new idea being developed by curriculum theorists, which I feel can help us get out of our means-ends dilemma. The thrust is to make successful performance the end and to use tests as indicators as to whether or not the student has reached the goals of instruction and, if not, what must be done. While there are several educators who worked on this problem, I would like to discuss briefly the approach being used by one of my colleagues at The University of Chicago, Benjamin Bloom. Bloom calls his approach "A Strategy for Mastery Learning." This is an apt title, because what Bloom has developed is first of all a strategy, a way for teachers to proceed. Also, the entire emphasis is on mastery of what is to be learned. Using Bloom's approach, both teachers and students approach learning with the expectation that only mastery of the information or task is acceptable. What is unique about the system, however, is that built into it are the alternative opportunities for students to reach mastery. Like most great ideas, Bloom's idea is quite simple. It is also quite adaptable to a wide range of subject-matter fields. If I may, I would like to sketch briefly some steps in the strategy for mastery learning.

First, the teacher must clearly specify the content and objectives of instruction. His students share a clear idea of the course expectations.

Second, he should establish a clear criterion for mastery of the subject matter. This criterion should be built into an evaluative instrument. For instance, 90 to 95% on each test would indicate mastery. The focus of the tests, however, is not to separate the bright from the slow, but to tell students how close they have come to mastery of the material.

Third, instruction should proceed as usual since the Strategy for Mastery Learning does not call for any radical changes here. No new methods or approaches to teaching are called for.

Fourth, after each unit of instruction, a short test is given. Each test has a twofold

purpose: first, to indicate mastery to those students who have demonstrated it and, second, to identify sources of difficulty which the students who have not demonstrated mastery need to overcome. Again, these tests are not used for grading students. Rather, the tests are used as feedback to students, to reassure students who have attained mastery or to indicate further work to be done by students who have not yet attained mastery. These short tests act as diagnostic progress reports.

Fifth, on the basis of diagnostic progress reports, the student is informed of the additional learning needed to achieve mastery. The test is devised so that it clearly informs the student of his source of difficulty and, especially, of the steps he should take. In this sense the test acts as a prescription for additional learning. This additional learning is to be completed apart from regular group instruction.

Sixth, the student uses alternate learning resources. This step is all-important. When the student has not gained mastery the first time through the material, alternative procedures are prescribed for him. Instead of having all of the students go over all of the material again, each student is given another opportunity to learn what he does not know. Some of these alternative procedures for individual students are as follows: re-reading the original lesson materials; studying alternative materials, such as a different textbook's treatment of the topic; using a programmed text or a specific workbook; reviewing the material with three or four other students in regular meetings; and, possibly, special tutorial instruction. This latter step is the most important one for the learner. He is given several chances and different ways to master the material before going on to the next units of instruction. And this is, also, the nub of the problem. Most of us have just one or two ways to teach our material. What the strategy for mastery learning would suggest is that we develop an array of alternative learning resources – materials to which students can be directed to help them overcome the points of difficulty.

There are two things that I find particularly appealing about the strategy for mastery learning. First, it is based on the idea that what we have set out to be learned, should come to be learned – not partially, not 75% worth, but should be learned completely. Twenty years ago as a high school freshman I received a just-passing grade in Latin I. However, it was enough to pass me on to Latin II. At the time, being well aware of what I knew and did not know about Latin I, this procedure struck me as being rather silly. I might add that in the year that followed, the folly of passing me on to Latin II was vividly demonstrated. This brings me to the second point about the strategy for mastery learning. I think we have a better chance of developing students with self-respect and with an excitement for learning if we insure that they have successful encounters with subject matter. What kind of self-image can we expect from a student who goes through school with a vivid knowledge that he is never learning everything fully and only has control over a portion of the material? A strategy for mastery learning, on the other hand, uses success as a criterion and aims at providing students with a sense of success.

Who Teaches and The New Technology

There is one final curriculum issue with which we should deal. It is encompassed by the questions, "who teaches?" and "how do we teach?" A casual glance around our schools should convince us that we have come a long way from Socrates' garden school, a long way from the boisterous medieval universities, and a long way from the little red school house of a few decades past. The reason for the change is not that teachers are getting any smarter than Socrates, Abelard or Jesse Stuart, but that they are getting more help – help in teaching the young. Socrates had to rely on the human voice. Perhaps he drew an occasional diagram in the dust. Today's teacher, however is supported by chalkboards, books, maps, overhead projectors, filmstrip projectors, motion pictures, audio and video tape recorders, programmed texts and teaching machines. Certainly not all teachers have such help and not all teachers know how to use it. My point is simply that this kind of help is available today and we are just at the very beginning.

What this new technology is forcing us to realize is that the essential role of the teacher is being changed. Let me illustrate. In the medieval universities, the teacher gathered his students in an open field and lectured to them. His classes were limited by the strength of his vocal chords. His knowledge was limited by his intellect and by the few books available to him. Then along came the invention of movable type and the printing press. Books became easily available to students and the university teacher was no longer the total source of knowledge he once was. The book, which can capture and store knowledge, the book which can be picked up and put down at the learner's convenience, radically restructured education. And, as Marshall McLuhan suggests, it radically

affected the way in which men think.

Today education is in the midst of another revolution, a technological revolution. Knowledge is again changing the essential role of the teacher. It is changing how he teaches, but it is also changing who teaches. Let me use another illustration. When a teacher uses a blackboard or an overhead projector to amplify and clarify his words, he is using audio-visual aids. However, when the same teacher puts on a film – say, dealing with procedures for setting a depth gauge on a drill press – the film does the teaching and the teacher becomes the aid. The people who made the film are the real teachers. This may be an uncomfortable idea for many, but it is one we ought to get used to.

The American schools have been discovered by American industry. Industry is readying a massive thrust into the schools with packaged materials of all kinds. These materials will do much of the traditional instruction by themselves. The human teacher becomes just another part of the learning system. In some cases, the teacher becomes an aid to the audio-visuals. In fact, many of the new corporate curriculum builders are working hard to develop what they call "teacher-proof" materials, materials which are so carefully designed that teachers cannot apply them incorrectly.

Whether or not we are disturbed by this development, whether or not we believe teachers can adjust to this change, is not the point. The point is that – barring national disaster – the revolution is upon us. Let me take one example of something that is with us today and may fundamentally change the nature of schools and the teaching profession. Recently, John Goodlad, the dean of the School of Education at UCLA, made the statement that "the computer will march relentlessly into our instructional lives ... We could equip every elementary classroom in the United States with a computer at the cost of one billion dollars." Incidentally, one billion dollars isn't really that much when we consider that it represents one-seventieth of what we are currently spending on national defense each year. There are many unanswered questions about computer-assisted instruction. There are many dire claims and many fears. However, computer-assisted instruction does offer a great potential. I am talking here about CAI units which act as individual tutors, that contain all the knowledge and theory developed by mankind, computers that are programmed with all we know about learning theory and put it into practice, that are programmed with all the learning characteristics of each student and operate up-to-date profiles of the skills and knowledge of each student. It is projected that these computer-assisted instruction units will be programmed not simply to teach skills and information, but also the important intellectual processes. It does not seem unreasonable, given the assumption that these units be continually pacing the student at his maximum level, and, thereby, cutting out all needless repetition and relearning, that in two or three hours a day at his console the student will be learning three or four times what he is presently learning in school. In brief, we may have the educational ideal of the student at one end of the log and, instead of Mark Hopkins at the other end, we will have the IBM Mark 2000.

Many of us are uneasy with the idea of children spending huge amounts of time interacting with computers. Some feel that the experience will be dehumanizing and that the educational process will become depersonalized. Although this is a very real possibility, I am sure that the same thoughts were stirred in the minds of those medieval teachers when books were made easily available to the students. And, too, we should keep in mind that much of what is, at this moment, going on in our classrooms is dehumanizing. Besides the legions of students who are bored with the content and the pace of instruction, there are many who are being left behind and cast aside. For many, our traditional classrooms are prisons where students are fettered in ignorance and frustration. I might add, too, that much of what teachers do now is demeaning and dehumanizing.

It seems clear, then, that whether we like it or not, the computer age is with us. With the computer will come drastic changes in our present answers to the questions, who teaches and how we teach. We can, of course, resist the advance of this new technology and fight any change in the status quo. However, I think this approach is doomed. If the computer and advanced technology can do certain things better than human teachers, we should welcome them. My friend, Dwight Allen, states the issue more sharply when he says, "Any teacher who can be replaced by a machine should be." John Goodlad, whom I quoted earlier, puts the issue in a broader perspective, "It is our challenge to find out how human beings and machines are to live together productively in tomorrow's teaching-learning environment."

<u>Summary</u>

The American schools have had a glorious history. We teachers have been left with

a great and noble heritage. A few generations ago we dreamed an impossible dream. We declared that we would build a school system which would educate all the young – the rich, the poor, the bright, the slow, the native born and the newcomer. And we achieved that dream of universal education. But the task is not finished. I started this address by underlining a few of the urgent problems presently confronting our schools and our society. If we are to extend the noble tradition of the American schools, this generation must solve these problems.

The first step toward finding new solutions is a commitment to change, a belief that we have the vitality and strength to change, a resolution not to be the passive victims of change, but to form and direct the change. Few of us, I hope, are like the eighty-year-old woman who recently wrote the President: "Dear Mr. President, Why do we have to go to the moon? Why can't we stay on this earth and watch television like the Good Lord intended?"

As you leave this room and begin to grapple with the very important theme of this conference, "New Concepts in Industrial Arts Education", I would like to leave with you the words of McGeorge Bundy, the president of the Ford Foundation. Bundy summed up the issue of change in education in these words, "We are in a grave and deepening crisis in public education. The burden of proof is not on those who urge change. The burden of proof is on those who do not urge change."

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W-8.0 AIAA
General Session III
Presiding, Ralph C. Bohn; Greetings, Hon. Arthur Naftalin, Mayor of Minneapolis; Introduction, Howard Nelson and Walter Wilson; Speakers, Arthur Turner, David Bushnell; Rec., Donald N. Anderson; Hosts, Ronald S. Walker, Harold Halfin, Laudie Kacalek, Donald C. Weber.

MAKING EDUCATION RELEVANT

Arthur E. Turner

Last Thursday, George Allen, the National Football League's "Coach of the Year", coach of the Los Angeles Rams, and a former student at my alma mater – Alma College – made a few remarks at the Annual Alma College All-Sports Reunion which I believe relate to my subject for this evening.

Coach Allen said, emphasizing the importance of personal achievement, that "The greatest thing in life – wherever you are – is to take an ordinary job and make something of it." Coach Allen has done that with the Los Angeles Rams, and his remarks fit my subject for tonight – the subject of "Making Education Relevant." Since I'm talking to industrial arts people, my subject might very well be: "Making a blueprint for the future of industrial arts", or "Building a bridge between the high school industrial arts and the industry they seek to serve."

President Johnson touched on the problem in his "Education Message to the Congress" on February 5 when he said: "A high school diploma should not be a ticket to frustration." Further, he declared: "We must do more to improve vocational education programs. We must help high schools, vocational schools, technical institutions and community colleges to modernize their programs, to experiment with new approaches to job training. Above all, we must build stronger links between the schools and their students and local industries and employment services, so that education will have a direct relationship to the world the graduating student enters."

That latter part, the bringing together of industry and the industrial arts program and the student, is the part that must be made relevant to prepare the student and make something of his education.

With many of you, trying to keep up with the fast-moving trends of industry is a serious problem. I understand there isn't too much getting together of industry and the industrial arts teacher. Many of you have only one-block hour a day in which to study industry, its methods and materials - an almost impossible task in this fast-moving industrial world. Also, I've been informed that industrial arts often becomes a dumping ground for students who fit no other curriculum, often without the use of satisfactory counseling methods to determine the student's aptitude for industrial arts, and that the biggest bug in the industrial arts field is the need for continually updating with industry.

In an article in Business Week last December, "How business schools welcome the world", one professor pointed out that "the most important question is what kind of graduate the business community wants from the schools, rather than what kind of graduate the schools want to produce."(1)

This brings me to the point at hand - the point of "Making Education Relevant" - and that is what we have been doing at Northwood Institute since it was founded almost 10 years ago in 1959. We decided from the start that education should be relevant to the needs of business, if our graduates were to be able to take over jobs immediately upon graduation and become productive assets to their employers. We began by finding out what business and industry needs, and before long we had them coming to us and saying, "We need this kind of course, that kind of program, and we would like to sit down with you and work out such a program." That is what we did - with our Automotive Marketing Program, our Insurance Management, Hospital Unit Management, Hotel and Restaurant Management, Food Service Management, Retailing and Marketing, Executive Secretarial, Advertising, Journalism, Business Management, Banking, Visual Arts, Performing Arts and other programs.

We sat down with the leaders of businesses and industries and worked out the courses, the method of evaluating the student's understanding of the work and the methods of placement which would meet the needs of the employer and the student. We did not stop there. Northwood set up advisory committees of these business and industry leaders, that were called upon to meet with us periodically to keep us up to date on changes in each particular field. In the automotive marketing field, the National Automobile Dealers Association provided a grant with which we developed a set of books on dealership operation - the first such set of books ever to be prepared with the blessing of the auto industry, and these are the textbooks we use today to train young men in all phases of good dealership operation.

I might add here that a great majority of our students takes about half their work in liberal arts, another 25 percent of their classes are in basic business and the remaining 25 percent in specialized classes for their selected curriculum. We are a business-oriented college, and most of our students are in a co-op education program, for we share interests in the key functions of business.

We believe we have programs that are relevant to the needs of middle management of the business world - that segment of business life on which we have decided to concentrate at Northwood Institute. Our efforts have been most successful over the past nine years. From a beginning of zero students at our first tiny campus in Alma, Michigan, we have grown today to four fine campuses not only at Alma but Midland, Michigan; West Baden, Indiana, and Cedar Hill (near Dallas), Texas - plus two extension centers in South America. Our student enrollment has grown from a very beginning enrollment of 103 students in 1959 to approximately 1,500 students on our four campuses today, and we include more than 50 students from many countries throughout the world.

In the student's selection of a career, we certainly need to be sure that he has the personality and talents needed for the job, and that there will be job opportunities for which he will be able to train. Quoting a member of the Employment Security Division of Indiana, I would like to say: "We hope that area employers will continue to evaluate their manpower requirements on a long-term basis - particularly in those occupations requiring a long training period."

The young person wonders what career lies ahead for him. The employers are concerned with finding qualified help - young people with sufficient training to be productive workers when they first start the job, able to meet people and carry on intelligent conversations with them, willing to learn and adapt themselves to the demands of the job, and, of course, a pleasing personality is always an asset.

Our job, yours and mine, is to bring the student and the employer together in the frame of reference that will enable each to improve himself - the student his ability, the employer his production or services - to the end that society also is benefited by improved goods and services.

Louis Harris, a public opinion analyst, in a nationwide survey some months ago, reported that only 12 percent of the college students made business their first choice for a career, but we certainly know that business has much to offer young people who have enthusiasm and the proper background of training. The need for skilled persons in the industrial arts fields is equally as urgent, and the rewards as gratifying, where enthusiasm and the proper training is found in the high school or college graduate.

It is interesting to note that nine-tenths of the college seniors who participated in the Harris survey agreed that free enterprise helped make this nation great, and three out of four believed that prosperity and profits go together. Perhaps the trouble lies in the rub that the only way people are going to get the good things of life is to work for them.

A bit of philosophy I'd like to throw in is this: right-thinking young people do not subscribe to the philosophy that the world owes them a living. A free society nurtures the individual not alone for the contribution he may make to the social effort, but also and primarily for the sake of the contribution he may make to his own realization and development.

In Northwood's business courses, not only is a knowledge of techniques and merchandising emphasized, but equal importance is placed on the development of good judgment and intelligence, personality and the ability to get along with others. We believe in bringing into our educational programs a sense of dedication and independence of judgment. We encourage our students with the thought expressed by Thomas Carlyle a century ago: "Have a purpose in life, and having it, throw such strength of mind and muscle into your work as God has given you."

We teach our students that whether they are at home, at work or in school, they owe it to themselves and others to give of their best. We urge them not to let frustration, hardship or opposition deter them from living up to their responsibilities with the quiet enthusiasm that can transform the humdrum of everyday life into a meaningful challenge. "Know thyself", Socrates tells us. "Be thyself", Plato asserts. "We must decide what manner of men we wish to be and what calling life would follow", Cicero advises, "and this is the most difficult problem in the world."

Isn't this what self-concept and vocational choice is all about? Observe what your native stock is, how it can be improved, and what it is fit for. You can regard work in the light of "chain-gang" prison punishment; or does harder, dirtier and longer work tend to mean dishonor for you? Or, you can find what you like to do and by adequate preparation find in your work a good name for yourself, good income, prestige and a career with honor. This is primarily a matter of intellectual growth and mastery of environment, once you have found the right niche and have adapted yourself to the demands of occupational mobility that come with career development.

I have presented these thoughts to you as I would present them to my students at Northwood. While I am talking to them about middle-management in business and industry, the qualities of character apply equally to the student in the industrial arts fields if he is to be successful in his job. The character skill must go along hand in hand with the craft skill in our preparation for careers, but sometimes today, do we not sweep the character skills under the rug in our hurry to get on with the job of developing and using our craft skills?

There are still opportunities in America today for all of us, and we will continue to take advantage of those opportunities to the degree that we make industrial arts education relevant to the needs of industry and business and relevant to the talents and capabilities of the student.

FOOTNOTE

1. December 9, 1967, issue of Business Week, page 124, Management.

Mr. Turner is President of Northwood Institute, Midland, Michigan.

INDUSTRIAL ARTS IN AN EDUCATIONAL SYSTEM FOR THE SEVENTIES

David S. Bushnell

Yesterday I had the pleasure of experiencing two seemingly unrelated events, one an intellectual exercise, and the other a social occasion. While neither of these experiences argue for dramatic changes in current educational practices, they serve to underscore the significance of the part which industrial arts must play in our public educational programs of the future. The first was a chance communication from Dr. Nicholas DeWitt, an Indiana University economist who had just completed a study of the skilled manpower needs in California. The report to the California citizens' Committee on Public Education, sponsored, incidentally, through US Office of Education funding, pointed out that California is relying upon a "brain drain" from the rest of the country to meet its skilled manpower needs. About 40 percent of California's skilled work force has had to be imported from other states since World War II. Dr. DeWitt goes on to observe that this obvious deficiency in productivity in the public school system is reflected in a 20 percent dropout rate before graduation from high school and a failure of 35 percent of the state's high school graduates to continue their education. Dr. DeWitt might have added that of those who do go on to junior college or a four-year institution, only 50 percent will successfully complete college. In other words, only two out of 10 high school students currently enrolled in schools across the country will successfully complete a college degree. Dr. DeWitt recommends that California's secondary schools must offer remedial and continuing education courses with an emphasis on job skills. In addition, he says more work-oriented and occupational education programs must be offered in all schools since more than half of the students do not go on to college. He recognizes something that all of you are well aware of, that the major job opportunities of the future will be in white collar and service occupations and that educational programs including counseling and guidance must be geared to these needs by providing "general" work-oriented education rather than the narrow, specific job-oriented kind. While it is unnecessary to make these observations to an audience of your level of sophistication I thought it would be of interest to you to know that economists, Congressmen, and others outside our domain are beginning to draw many of the same conclusions which have for so long been the touchstones of industrial arts educators.

To quote a recent speech by Minnesota Congressman Al Quie:

> "I have seen the statistics that show that of the young people who leave school and go out to work with less than a baccalaureate degree, only one in ten have a job skill to take with them. And that's a pretty poor record for our educational system.
>
> The heartening fact is, however, that our educators are aware of this shortcoming in our system and I expect that they will play their role in making long needed changes."(1)

The second event, one which I enjoyed immensely, came about through the selection by the Chief State School Officers throughout this country of a man whom they recognized as the "Teacher of the Year." His name is David Graf, an Industrial Arts-Vocational Teacher at Sandwich High School in Sandwich, Illinois. It was my pleasure to speak to an august body of educational statesmen in Washington, DC, yesterday on Mr. Graf's achievements at a luncheon in his honor. Among other notable successes, Mr. Graf had pioneered what LOOK Magazine described as a "custom-tailored" classroom where students' interests, abilities and aspirations were recognized through tailoring programs to fit their individual learning styles and backgrounds. Mr. Graf, an unassuming but obviously talented teacher, dramatically illustrated what learning theorists have long argued is a necessary approach to revitalizing education in the classroom, particularly for the disadvantaged and urban ghetto student. The difference is that Mr. Graf has been able to incorporate these insights into his own repertoire of skills through actively involving the student in the learning process. By effectively linking a student's interest in a vocation with an awareness of the need for a basic education – one designed to reward rather than punish a student – formal education could be made more palatable. It is this

same basic concept which we hope to incorporate into an Educational System for the '70's. I would like to spend the remainder of my time describing in some detail this effort which is now moving off the drawing boards into a five-year program for implementation in 17 school districts around the country.

Industrial arts, together with other school subject areas, is expected to play an important role in the development of this new and exemplary high school program labeled an "Educational System for the Seventies (ES '70)". This pilot effort is a response to the often expressed observation that the educational program of many of the nation's schools are not relevant to the needs of the majority of American youngsters. The recent report by the National Advisory Commission on Civil Disorders (the Kerner Report) described some of the serious conditions of our inner city schools and recognized the urgency for dramatic changes in our present-day system. Informed observers of the educational scene have noted that many public schools are non-rewarding, that students are "turned off" by their learning experiences, that the learning environment is hostile and custodial rather than involving and challenging, and that teachers are unable to respond to individual differences in students.

Recent shifts in the structure of the labor market have also imposed increased demands upon public education to prepare young adults and experienced workers alike for changing work careers. The shift from production-oriented occupations to service occupations has accelerated the need for communicative and social skills in addition to the more familiar manipulative skills. Many of the more traditional entry-level occupations are now unavailable to the high school graduate. With 26 million young workers entering the labor force this decade, new jobs must be created. Unskilled or low-skilled jobs frequently offer only interim employment opportunities. Today's rebellious youth look for a challenge as well as a paycheck. Economic security is being rivaled by a yen to be involved – uptight with reality – as the saying goes. Where's the action – unfortunately not in our schools.

Such problems regarding the current school system and the job market should generate much concern – and they do. Educational leaders and classroom teachers are not insensitive to them. Their awareness is coupled with a growing sense of frustration at hearing of the many exciting innovations in teaching. Such innovations as individually prescribed instruction, programmed learning, computer aided instruction, team teaching, flexible scheduling, ungraded classrooms have been amply demonstrated as feasible and desirable. The popular media are continually reporting the favorable results of these techniques. However, most of these valuable new tools are not commonplace practices. A coordinated application incorporating various innovations into even a small percentage of schools has yet to be worked out.

Educational researchers have made significant advances in their understanding of the learning process, the need for curriculum innovation, and the use of new instructional technology. How distressing it is when one considers the tremendous lag time between initial research findings and implementation of these findings. Even with the rapid escalation of federal research dollars for education, the return on the investment to date has left something to be desired. In short, it seems that a massive and radical redesign of our approach to improvements in secondary and post-secondary educational programs, particularly vocational and industrial arts education, is imperative. What does the citizen of the '70's need to know about himself, his community, and his role in society? What kind of job skills does he need to qualify for employment? These are the questions to which a major curriculum change effort must be addressed.

Recognizing that the money being invested by the Bureau of Research in the US Office of Education in curriculum development might yield a greater return, the Bureau has developed a two-fold strategy for meeting the needs of secondary education. First, small scale curriculum development efforts will continue to be funded to meet immediate and pressing needs. Second, a new method of defining goals will be adopted using a more systematic approach pioneered by the defense and aerospace industries. While we are well aware of the benefits derived from the application of such an approach to the complex problems of weapons systems development and aerospace research, no large-scale efforts have been made to adapt such an approach to the needs of education. John Flanagan has observed that "specific factors which have prevented the effective use of these approaches in education are a lack of well-defined objectives and inadequate measuring procedures to determine whether the student has achieved the objective set for him".(2) We are well aware of the potential benefits of applying a systematic approach to educational problems. Such an educational system offers an opportunity for a clearer definition of goals and a

method of linking such goals with appropriate actions in order to present to the educator tested alternatives to present practices.

Bearing in mind the need for a dramatic overhaul of many of the nation's secondary schools, representatives of seventeen local school districts, fourteen State Departments of Education, and the US Office of Education were invited to meet in Fort Lauderdale, Florida, in May of 1967 to devise a program for the development of a new comprehensive and secondary school system for the '70's. Those participating recognized the growing disparity between traditional curricula offerings of secondary schools and the fast-changing needs of large segments of the American population. The central theme of the conference was built around the necessity for bridging the gap which exists between the academic, vocational and general education areas and to consider ways of reducing this traditional separation. The conferees concluded that an adequate high school education should permit the development of basic learning skills, appropriate entry-level job skills, and a foundation for further study at higher educational levels. Horizontal and vertical integration of subject matter fields was felt to be essential. Physics students, for example, might go to the industrial arts department for first hand experience with the principles of pulleys and levers. Boys training to be mechanics might write English essays on how to repair a car. Journalism students might develop a better overall grasp of their area of work by participating in a graphic arts program. By focusing on several broad objectives of secondary school education, each superintendent represented at the conference hoped to bring about a much-needed integration of the academic and vocational curricula offerings to better serve the needs of the college-bound as well as the non-college-bound students.

The American high school, they concluded, should provide a truly comprehensive education for each of its students. A capability for citizenship involvement, quality education and career preparation have long been recognized as acceptable goals for American education. Our school system has the responsibility to assure that each child attains these objectives. In equipping young people for their roles as adults, the school must be responsive not only to the student's intellectual needs but to his personal, social and career needs as well. The student should receive an education which will provide him with a range of post high school options. He should have specific, immediately marketable occupational skills as well as a broader understanding of our free enterprise system in a democratic society. He should be prepared for career development with the recognition that he will probably progress through several different jobs in his working life. Each student should also receive academic preparation of sufficient depth and rigor to permit his entry into a university or other form of continuing education if he so chooses. He should also be prepared to participate in our society as an effective citizen with knowledge of the means by which he can bring about changes in the society if he feels it necessary to do so. He should be aware not only of his responsibilities but of his rights as a member of a democracy.

The US Office of Education agreed to join with the fourteen states and seventeen local school districts represented at Fort Lauderdale in designing and developing a new educational program at the high school level which would test these objectives and the most promising innovations in an operational setting. These schools will serve as a flexible staging area where the interaction effects of significant innovations can be tested and revised in terms of their contribution to student learning and cost/benefits. The seventeen schools are now participating in the planning for this program and will serve later as the sites for operational demonstrations.

The overall plan, the first phase of which is almost completed, will identify all of the activities that must be completed before the total new curriculum can become operational. The activities can roughly be classified as research, development or demonstration. While personnel from the schools will be involved in the research and development projects it is likely that in most instances the primary contractual responsibility will reside with outside organizations. These organizations will include universities, private industry and not-for-profit groups. Many of the projects, particularly the developmental ones, will be awarded on a competitive basis. The local schools will have primary responsibility for the test and demonstration of the instructional programs.

In developing the overall plan, careful consideration will be given to off-the-shelf materials which have application to the program requirement. Estimates are being made as to the initial start-up and personnel costs required to adapt or modify existing materials and practices so that they can be incorporated into the total system. There are many variables in the educational system—the instructional objectives, the role of

teachers and administrators, the physical environment, the motivation and abilities of students, the administrative practices, and the instructional processes and materials. No one variable is entirely independent of the others in its effect on student performance. Unfortunately, most of the variables have been studied in isolation from one another. Optimum results are not achievable unless there is freedom to vary the whole range of factors. The ES '70 program should provide that freedom.

One of the major goals of the program will be the appropriate integration of the occupational and non-occupational parts of the curriculum. This can best be achieved by defining and continually redefining the educational objectives in operational and measurable terms. This will be done in each discipline area, English, math, etc., and then the objectives will be regrouped on an interdisciplinary basis in coherent sequences, eliminating the gaps, illogical patterns and wasteful redundancies of the current subject-oriented curriculum. The kinds of instructional systems and curriculum materials needed to implement a new high school program will be analyzed. Where the learning resources do not exist, new materials will be developed. A series of tests and revisions will follow until the specific objectives are consistently reached by all learners.

A major variable of the program which will be affected by this radical redesign of the secondary school curriculum is the role of the teacher. It is clear that it would be significantly changed in the context of ES '70. The teacher will have to be familiar with the methods and media of educational technology such as computer-mediated instruction. He will have to learn how to manage all the instructional resources which will become available to him. At this juncture, however, we have only begun to analyze this new role and, at best, we can only anticipate certain changes which might occur in the classroom environment. For example, we are quite certain that defining educational objectives in operational and measurable terms will lead to the development of an instructional program in which some academic and vocational experiences will be integrated. In other words, the industrial arts teacher will probably become part of a team of teachers whose expertise runs the gamut of several fields. He may be responsible for incorporating appropriate materials from various disciplines into the new industrial arts program which emerges. Organizational and administrative principles of industry, an area which is typically covered in social studies, might find its way into the industrial arts curriculum. The team approach should provide a reciprocal relationship among the members and disciplines they represent. In addition, this yet-to-be-built secondary school program will be designed for the college-bound and non-college-bound alike. Therefore, all students, not just those who are identified as academically oriented, will be participating in learning experiences incorporating industrial arts. Such experiences should expose all students to the concepts of the world of work.

The consequence of this several-year effort should offer at least one tested alternative to existing curricula. It should be capable of adoption, in whole or in part, by a new school (one having no involvement in its development). The system by which the program's objectives are achieved should be tangible, demonstrable and replicable.

To recapitulate briefly, the system which has been described should provide a comprehensive secondary school education for the forgotten majority of our nation's youngsters. Characteristics of the system can be generally described as learner-centered rather than teacher-centered. Carefully developed, individually tailored learning experiences will be sequenced to insure minimum attainment of commonly agreed upon educational goals for all graduates. To achieve these ambitions will require all the resources that we can marshal—human as well as financial. Fortunately, I'm convinced, this country has those resources in rich abundance.

FOOTNOTES

1 From a speech by Congressman Quie before the National Association of Manufacturers, December 1967.

2. Flanagan, John, "Functional Education for the '70's, PHI DELTA KAPPA, September 1967, page 27.

[illegible]nett is Director for Vocational Education Research, US Office of Education, Washington, DC.

Th-10.0 AIAA
General Session IV
NEW CONCEPTS IN LEARNING AND INSTRUCTION
Presiding, Ralph C. Bohn; Greetings, Raymond V. Nord; Introduction, Leonard W. Glismann; Speaker, Asahel Woodruff; Rec., Samuel L. Powell; Hosts, Stanley Rose, Gary D. Novinska, Joan J. Deady.

NEW CONCEPTS IN LEARNING AND INSTRUCTION

Asahel D. Woodruff

So much has been happening to our concepts of learning and instruction in the last ten years that we cannot at the same time describe the full picture and make any of its parts fully understandable. It seems preferable today, therefore, to attempt a survey rather than a clarifying discussion of any of the rather detailed segments of the area. For that purpose I have selected five themes under which it is possible to make a reasonable and integrated summary of what is now developing. Those themes are: the nature of human behavior and learning, the nature of subject matter, the concept of a quality-control system in education, the conditions in school that can make behavioral change possible, and the change now occurring in the model of education in America.

The Nature of Human Behavior and Learning

We have long defined learning as a change in behavior, but we have not carried this concept into school practice. Instead, we have acted as if learning is the acquisition of verbal information. We have implicitly assumed that acquired verbal information will change out-of-school behavior. That assumption is almost wholly false and misleading, and education has suffered the devastating consequences of this fallacy.

If we mean to change behavior, then we must focus attention on the nature of behavior, and on its change processes. Our study of behavior must become one of direct phenomenal description, not one of theoretical explanation. One of the conclusions that grows steadily when we begin to describe is that there is no such thing as "learning" in and of itself. There is only behavior, and we see it changing sometimes as it goes on. The key to the change process is to be found in the behavior process.

It soon becomes evident that behavior is cybernetic and cyclical. That means that it operates through a cycle of interrelated phases which affect each other through a feedback process, and which give it a self-correcting capacity. This picture is not evident if you observe academic behavior in school, because the normal cycle has been seriously interrupted by school patterns. It is clearly evident only in out-of-school behavior.

The feedback capacity consists of the perception by the behaver of the consequences of his behavior, and the subsequent reshaping of his behavior by those consequences. A cycle model of behavior makes this process visible, and proves to be highly useful as a guide to educational planning. Much of what follows has resulted from applying this cyclic notion of behavior to the reconstruction of educational practice.

Along with this recognition of the behavioral cycle, another line of development is also fundamental to educational planning. It is the current effort to make one complete picture of human behavior out of the key ideas which have accumulated over a century. The task is to match the full scope of human behavior to the comparable scope of the task of education in affecting behavior. This requires assembling the obvious qualities of behavior into one coherent model. We have been guilty of fighting over pet theories of learning. Proponents of a particular theory have attempted to explain all of human behavior solely in the explanatory terms of that theory. Human behavior is too complex for such over-simplification. We will have to recognize that all of these components are present in almost every human response to environment:

Unconditioned reflex responses.
Classically conditioned signal responses of the Pavlovian type.
Operantly conditioned voluntary behavioral program responses of the Skinnerian type.
Verbal repetition responses of the mnemonic type so long studied from Ebbinghaus on down.

Conceptual response patterns as described by Tolman, Hebb and, more recently, many others, including both cognitive meanings and affective or value-type elements.

Subliminal or intuitive levels of conceptual response, as recognized early by Freud and perhaps more adequately and usefully by Kubie, Bruner, MacKinnon, Penfield and many others.

They are not mutually exclusive or competitive phenomena as some of our theoretical arguments or claims imply. They are mutually supportive and interacting phenomena. All of them are required to provide all of the amazing facets of human behavior. They have no fixed balance among them. The balance shifts as the complexity of one's situation shifts, and as the person becomes aware of that complexity. In some situations the more fixed and conditioned patterns provide more control, and in other situations the cognitive and flexible capacities become dominant. It is not at all difficult to trace these shifts to qualities in our subject matter fields, and to identify by means of task analyses how we must provide for each of these components in a given educational objective.

It must be almost painfully obvious that if what I have been saying is true, educational planning cannot be the careless, impressionistic and incidental sort of activity it tends so often to be. It must become analytic and precise. It is no mere coincidence that the high level of unsolved social problems in our lives goes along with the lack of rigor in educational planning. There is no lack of ideals or of social facts in our bodies of subject matter, but the educative process has failed to make them operative in human behavior.

One further product of patient description of human behavior is the discovery that we can identify three major types of holistic or organismic behavior, and that all of the component aspects of behavior just described are present in each of these types although in quite variable combinations.

Here is a summary of those types (next page) which is proving highly useful as a basis for identifying behavioral objectives in all subject matter fields, from the most simple and mechanical to the most complex and esthetic. They first became visible to me in a project to translate the field of foods into behavioral form. Since that time, I have found them equally helpful for defining behavioral objectives in my own field of educational psychology, in teacher education courses, in the field of art, in English, and in music and reading. With this much transfer, I am convinced they will work equally well in all subject matter fields, although they take on substantially different specific patterns for each field.

A little patience will enable one to become accustomed to thinking of a field of study in these terms, after which it becomes relatively easy to begin stating objectives in behavioral forms which are faithful to daily human behavior and which meet the criteria which make them helpful in instructional planning.

The Nature of Subject Matter

At the level of generalization used by the Educational Policies Commission, all the important goals of education are in large behavioral terms. They speak in terms of competence in coping with one's life situations or one's environment. It follows, therefore, that environment is our subject matter. Somehow we have lost the reality of environment in our schools. We have verbalized our knowledge of it and handed those verbalizations to students in the form of printed materials or as lectures and teacher-dispensed verbal information. This sell-out to verbalism has been most complete and most educationally destructive in fields like the social studies, which deal with the most complex forms of human behavior and interpersonal interaction. It has been less complete and less destructive in the vocational fields and in subjects which rely heavily on laboratories to simulate the working conditions in real life for which they attempt to prepare people.

The verbal information which dominates so much school work is incapable of making a person competent in coping with his environment. In those fields, which matter so crucially in our culture today, we have acquired our actual behavior patterns outside of school rather than through formal education. Our behaviors are thus empirically real. But as is so often the case with that kind of learning, they are riddled with our subjective and biased perception of what is going on; they are heavily dominated by our own selfish motives; and they are too subliminal and unrecognized, even by ourselves, for us to detect their flaws and socially dangerous misconceptions. In view of these dangerous characteristics of out-of-school learning, it is imperative that we learn how to affect these behaviors through formal education, and to keep these dangerous misconceptions from

Type 1: Identifying, Discriminating and Matching
(Covert Behaviors)

PERCEPTION OF REFERENTS in the environment.

THINKING about what has been perceived in both present and past and ORGANIZING IT CONCEPTUALLY.

IDENTIFYING AND DIFFERENTIATING referents and their various properties and uses.

COMPARING AND MATCHING referents and their properties and uses.

IDENTIFYING (choosing) A GOAL (a condition or product to seek, produce or accept).

CHOOSING MATERIALS (or elements of any kind) required for producing the goal.

Type 3: Verbally Communicating
(Overt Linguistic Expressions of Type 1 Behaviors)

VERBALLY IDENTIFYING referents and discriminating among them.

SPEAKING OR WRITING discursive sentences to express one's thoughts and judgments.

REPEATING memorized information or other symbolic materials.

USING TAXONOMIC AND TOPICAL SYMBOLIC HIERARCHIES to represent bodies of information.

Type 2: Performing Adjustive (Instrumental) Acts upon the Environment
(Overt Nonverbal Behaviors)

MAKING AND EXECUTING DECISIONS.
- Locating and securing materials required for reaching a goal.
- Preparing the materials for processing into the goal or product.
- Processing the materials into the goal or product.

PERFORMING MOTOR ACTS in any of the foregoing behaviors.
- e.g., using a knife, sawing a board, bowing a violin, making a broad jump, reading a prepared paper, conversing on a casual level.

FOLLOWING CUSTOMARY PATTERNS AND ARRANGEMENTS in any of the foregoing behaviors.
- e.g., setting a table, arranging a room, observing a schedule, exhibiting a customary manner, carrying out a stabilized set of steps in a process.

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dominating our behavior as they now do.

With all of that built-in blindness, human behavior and human learning outside of school still gives us our clearest picture of the manner in which behavior forms and changes. What we see, without exception, is persons in environmental settings, interacting with that environment. Each human response is to some <u>specific</u> set of objects and events, never to a generalization, a principle, an abstraction or an ideal. Nature is always specific. Furthermore, each human response is a specific response, under the direct influence of the specific circumstances that are present, and of the person's stored set of psychological and physical predispositions. The person may bring his own generalizations and principles to bear on his thoughts in a specific situation, provided he has constructed any of his own and has learned how to use them effectively. Note this very important educational fact, however, that we cannot confront a student with a general situation. There is no such thing. If we try to do it, and we do try much of the time, by means of verbalistic general communications, we do so at the expense of cutting the person off from his environmental contact and interrupting his behavioral cycle with its shaping process. There is no better way to interfere with real learning.

The environment, this real and concrete world around us, is composed of specific

objects, engaged in specific events and processes, which are producing specific consequences. Those consequences impinge on us, affecting our sense of well-being. A person can only learn what he can perceive in these specific and real situations. He can do remarkable things mentally with what he acquires in this way, but all of his mental learning begins here. If we try to have him engage in higher mental processes without an adequate sense-perceived base, we force him into meaningless memorization of what we try to teach him. The model of levels of knowledge can be used to show that behavior always occurs at the bottom level, and the other levels are in the person's storage system to be drawn upon. A model of mental processes in learning shows the same thing.

The elements of the environment are stored within the person as a result of his perceptual response to them during his interactions with them. As the interactions go on, both the environment and the stored variables are changed. By this process behavior is changed. There is no other way to do it. Clearly no one ever gets away from subject matter, unless by our own misdeeds we surround students with verbalistic materials so completely that they cannot see the real world of subject matter through it. The subject matter of any field becomes visible as one becomes aware of how the objects and events in his environment affect him socially, politically, chemically, biologically, musically, economically, agriculturally, transportationally, nutritionally, vocationally, and so on. Environment really consists of all of the vocational, esthetic, academic, political and other events going on around us and affecting us. Thus human behavior consists of taking part in those events. Human behavior is shaped by taking part in those events. Those events have to be our subject matter in school if we expect to affect the out-of-school behavior of our students.

It is an inescapable conclusion, from this picture, that a shift – from verbal information and verbal knowledge objectives to overt behavioral objectives – will greatly improve the effectiveness of formal education. If we undertake this shift, the curriculum development task will then become one of identifying the life behaviors a person needs in order to cope with his world successfully, and of arranging them into some learnable sequence. We will have to identify specific behaviors, not just the large and vague general behaviors we have set up in the past, as our major goals.

Similarly, the lesson or unit construction task then becomes one of making a task analysis of each specific behavioral objective, finding the component concepts, operant behaviors, data and vocabulary needed to perform each behavior, arranging those component parts in a learnable sequence, and creating a realistic setting in which those concepts and proficiencies can be acquired. Each subject matter field will have to be sure it identifies the essential components in their required balance, and in the essential combination, for the behaviors it seeks to develop. A major weakness at present is lack of this balance, in the form of overloads of verbal information, or of performance emphasis, or of irrelevant content for the expected behaviors, or of over-abstraction of conceptual content.

The Concept of a Production System and the Companion Concept of a Quality Control System

Any attempt to produce a specified end product by means of a treatment system of some kind has all the elements of a production system. Those elements are:

A set of specifications for the end product. (objectives)
A raw material to be brought to that set of specifications. (learners)
A treatment to be applied to produce those specifications. (curriculum)
A system for applying the treatment. (methodology)

Any attempt to measure the degree to which the specifications have been achieved, and to improve the system for better achievement, has the basic elements of a quality control system. Those elements are:

The specifications. (objectives)
Measurement of the finished product in terms of the specifications. (testing and measuring)
Identification of the specifications not achieved. (evaluating)
Identification of the point of failure in the system. (diagnosis)
Alteration of the treatment or process at the point of failure. (program development)

The education system is a production system, and it will respond readily to a quality control system when we escape from ambiguity and become specific. The improvement of education is impossible without these two concepts and their activation. With behavioral objectives, and with intelligent planning, it becomes possible to activate these two powerful concepts.

The Conditions in School that make Behavioral Change Possible

Here is a premise which is factually sound: Behavior changes only when the person is engaged in a real interaction with his environment and is suffering the consequences of his behavior; that is, when his behavior is being shaped by those consequences. A corresponding definition of learning is: A set of self-propelled, environment-consuming, response-altering actions. Can we create conditions that will result in this kind of human behavior in the school? There is no doubt that we can, but there are some rather definite requirements. Here are five, listed in what I regard to be the order of their relative importance, with the most essential condition first:

(1) The learner must be confronted with an interaction task, one that is real and essential in out-of-school life. It must be specific and unambiguous.

(2) The behavior must take place in a real referential setting. The actual objects and events are to be present, and the interaction is to be with them, not with a teacher and a verbal substitute for them. The skillful use of media and of simulation processes will make this more and more possible.

(3) The learner's behavior must go through the full shaping cycle, consisting of perception, conceptual thinking, decision-making that is "for real", an overt execution of his decision in actual form (not merely hypothetical or imagined), and perception of the consequences of his response. This may sometimes be difficult to arrange, but the difficulty will diminish with trial and with thoughtful planning.

(4) The learner must have access to a continuing series of tasks when he is ready for each one. They must be tasks that lead sequentially to cumulative competencies. The tasks must be available to each learner without making him wait for a teacher, or for a class to get ready. The tasks must have adequate self-directing instructions so the learner can be self-propelled and self-directing. The tasks must be supplied with the essential learning materials and conditions in readily available form.

(5) The circumstances must be such that the learner is dominated by his objective and its task and materials, not by an information-dispensing teacher. Supporting actions must be available from the teacher as needed. However, the direct and most effective influences must emanate from the environmental referents, not from the teacher. The teacher's influence will be confined to setting up the learning theatre, guiding attention as necessary, eliciting the high-education responses of the Type 1 and Type 2 sort, rather than verbalistic memory responses, encouraging initiative with low-control devices which preserve freedom of action for learners, and maintaining discovery activities in place of "telling" activities. In these terse sentences we have skimmed through a set of very important characteristics of good teaching. Any adequate description of them and of how to carry them out would require many hours, but good descriptions are already in our literature and are appearing constantly in current publications.

A Change of Models in Education

The scope of the change implied in these ideas is much greater than many seem to recognize. It is tempting to say that there is really nothing new in any of this, that we are just cycling through old ideas; that many of us have been doing these things all along; that good teachers do these things all the time; that a few strategic readjustments will take care of our needs; or that they are not really very great changes, and that even when we make them we need not expect any significant gains in results. These responses come out constantly. Perhaps there is some reason to be skeptical of new ideas in education, for certainly we have profited little from many notions that were heralded as the sure cures for our troubles.

With all due awareness of the foolishness of unwarranted optimism, I am still convinced that the concepts now available to us are by all means the most potent we have ever had in education. The shift now in the making is of diametric and not of tangential quality. A few very far-sighted giants in past educational thinking have talked of what we are now trying to do, but there has been no effective implementation of these ideas until very recently. How can the nature of this shift be portrayed? Perhaps its most disruptive contrast is found in the respective roles of the learner and the teacher. With a little over-

emphasis I think I can make the contrast at least partially visible.

For that purpose I suggest that educational practice has been based from the very first, with minor exceptions, on what we could call the "To Teach" model. Attention has been on what teachers do. Methodology has been the focus of attention. "To teach" has meant largely to dispense verbal information to listening students. The teacher has been the most active person; has given knowledge to students (or tried to); has directed all learner behaviors; has been the main source of both materials and instructions; and has graded learners on the basis of their ability to repeat what they have been told. The shift that is now occurring is antagonistic to every part of this model. The newly-emerging model does not even refer basically to the teacher and his activities. It refers instead to the learner and his activities.

The "To Learn" model is quite different. We have been describing it today, in our discussions of what learners must do in order to change their behavior. Learners can't do these things until we accomplish a major stage shift. The teacher must get off the learning stage, and the learner must come up front and center. The teacher must move into the wings and become a stage setter, a planner, a consultant, a trouble-shooter, a diagnostician and prescriber, a very indirect and non-disruptive influence that sustains the learner's absorption in his tasks. The classroom must divest itself of its excessively verbalistic nature and become a realistic referential environment within which learners engage in real tasks in no significant sense different from those that make up their out-of-school life. From this point of view, the vocational fields generally show up to a better advantage than some others. A more troublesome task may be that of doing an adequate job with the conceptual contact in the field.

If we make this kind of stage shift, all of the other components of the education system will have to change in compatible ways. The component parts of the verbal "To Teach" model will not fit compatibly into the "To Learn" model, and if we try to plug isolated bits of the "To Learn" model into the "To Teach" system, they will look bizarre and ineffective. This we have learned over and over in efforts to make such gradual shifts.

It appears that the most possible break in the cycle of the old system can be made in the form of a new lesson unit; that is, a behavioral task objective with its supporting materials. If such units were available, students could be helped to reorient themselves, away from the teacher, and toward the task. Teachers could then start to shift their roles accordingly, and the other adjustments could follow. This, too, we are learning in some of our transition projects. The shift is moving along rather substantially in various places, and the indications are generally positive; but we need not expect it to be smooth and easy. It will in fact be disorderly in some ways and will require continuous learning on our part. I doubt if any previous year in my experience has been so marked with learning for me, and so exciting. The nicest thing I can say to you is that I hope you get involved in the same disruptive and stimulating activities, with the same fatigue, the same relentless pressures. It is well worth the strain.

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Th-12.0 AIAA
General Session V
Presiding, Ralph C. Bohn; Greetings, Donald V. Dunnan; Introducers, Sherwin D. Powell, Fred Baer; Speakers, Robert Seckendorf, Harold A. Foecke; Rec., M. J. Ruley; Hosts, Leland White, William Kemp, Thomas W. Gurbach, Samuel L. Powell, Harlan D. Clark.

WHERE SHOULD WE BE GOING IN INDUSTRIAL ARTS?

Robert S. Seckendorf

Charlie Brown's little friend Linus said recently, "No problem is so big or so complicated that it can't be run away from."

From my vantage point, the words of Linus have particular significance to industrial arts educators throughout the nation. To a real degree, it reflects what I have observed

happening during the last 20 years. My five years' absence from active participation in the industrial arts field has brought into sharper focus the issues and problems which exist.

This evening I would like to do several things. First, I will spend a bit of time scolding my colleagues who labor at all levels (including state education departments – for we are not without sin). Second, I would like to take exception to some of the attempts to achieve dignity and status. Third, I will identify several issues which are particularly timely. Fourth, I will repeat within the context of this presentation the five principles or beliefs which were so aptly entitled by The Journal editor as a "Policy for Action" and last, some comments about what we should be doing.

Let's look, then, at the big and complicated problem away from which so many have been running.

Let me ask several questions. How is industrial arts taught in your schools today? How does it differ from what was taught 50 years ago? Has it changed at all? Are broom-holders and windowstops still being made? We hear constantly about our rapidly changing technology: but how rapid are the industrial arts programs changing?

During the past 60 years, the method of travel has changed from the horse and buggy, to the automobile, to the airplane and now to spacecraft. The speed of travel has increased from less than 35 miles per hour to more than 25,000 miles per hour in the same period.

Several years ago the environment surrounding the beginning of industrial arts was described in this manner: "In 1815, when industrial arts, as manual training, came into being in this country, we had practically none of the things we now consider essential. Electricity was hardly known except as a laboratory science. Edison was just beginning his work. Electronics was then unknown. There were no radios, television, telestars nor the host of electronic devices which are a part of our lives today. The automobile had not made its appearance, and the Wright Brothers had not even conceived of their 'heavier-than-air' flying machine. Steel consisted largely of low grade iron. As late as 1930, there were barely a half dozen different kinds of steel. Today there are literally hundreds. Aluminum was so rare it was considered a precious metal. Plastics were unknown. It was a period of time which, in many ways, was still a handicraft culture. It was under these conditions that industrial arts was born."

Some industrial arts programs, I have observed, have not progressed much beyond a program fit for 80 years ago.

What are our children learning in industrial arts? Have you asked yourself this question lately? Let me illustrate the meaning of my questions with a delightful bit of fantasy written by Dr. Robert Swanson and which so captivated me that I preserved it with utmost care, waiting for a time when it would be useful to me.

He described how a laboratory course in chemistry might be taught if some current industrial arts methods were used.

"Operations would be defined: how to light a Bunsen burner, how to pour liquids from a beaker, how to test a solution with litmus paper. Information topics would be listed: gases for Bunsen burners, materials from which beakers are made, the composition of litmus paper. A project would be developed: a pint bottle of ammonia water. The instructor would demonstrate how to perform the operations and give lectures on the related topics. He would point out that ammonia water is useful for washing windows at home. The students would master the operations and produce a pint bottle of ammonia water. It would probably be displayed at home but not used for washing windows because the boy's mother would want to keep it as a memento of her son's lab work. Students would ask to come in during extra periods to make more pints of ammonia water. And next year they would sign up for advanced chemistry to make gallon bottles of ammonia water."

Ridiculous, yes. But what does a student learn in industrial arts by following a series of operations or steps and building a project? Skills, certainly – tool skills which will define the extent of his manual dexterity and which will permit him to develop one of several hobbies which require the use of tool skills. But what beyond the development of tool skills does he learn?

Some of the leaders in the field of industrial arts have been professing the need for rapid change as well as experimentation in our programs for years. I agree that change is needed and that we must experiment; however, not with materials, but with ideas, concepts, methods, content and even course titles. Through all this, however, experimentation must be valid, controlled and reasonable. There has been so much talk of problem-solving, mass production techniques and experimentation that many teachers jumped on the band wagon. And many of them were taken for a sleigh ride instead.

Let me illustrate the confusion by describing the activities of some teachers using the "new theories". In one class, a boy sorts through a batch of welding rods and tries several unlabeled varieties on some scrap metal. When the teacher is asked why the welding rods are not labeled and stacked according to kind, his answer is that this is problem-solving. The boy is doing research – finding out which rod is best for his purpose (and, of course, if they were labeled he would be able to find in a book a description of the proper rod for the job).

And mass production. In one school, part of a mass production job required the printing of desk calendars, each day on a separate sheet. The teacher did not realize that there were 365 different changes of type and lock-up as well as 36,500 press runs in order to turn out 100 calendars. And all this on a hand-lever press.

If the picture I have painted doesn't fit your own situation, I would hope that you will ignore my chastising. But don't be too smug – I'm not finished yet.

Recently I was exposed to what I gather is the latest episode in the grand scramble for change. This I characterize as the "Era of Dignity" – an "operation uplift", if you please.

If some of what I said up to now has had a low sugar content for some of you, then these next remarks might be characterized as a little bitter.

In terms of program decisions, disciplines and domains have little meaning to me. These words, with categorical descriptors added – such as psychomotor, affective and cognitive – leave me cold. I am willing to admit that I am not a scholar and that industrial arts lacks a scholarly base as well. I'm quite willing to say that industrial arts doesn't need a scholarly halo or mantle in order to be successful or acceptable. On several occasions the discipline of industrial arts has been explained to me (or at least an attempt was made) and the various domains were translated as well. Little success was achieved in getting me to accept these dignified words.

Let me make myself abundantly clear. Industrial arts <u>is</u> a school subject and <u>is</u> important in the general education pattern of all students. I wouldn't know a discipline if I fell over it – but I think I certainly know what a school subject is.

And the domains – I really do not know what is wrong with the use of such words as "skill in the use of tools" – "outcomes such as appreciation and values" – and "subject matter or content."

The contention that school administrators would understand disciplines and domains better than they would simple plain language is, in my judgment, nothing but an excuse for an attempt to be something industrial arts is not.

If I plead for one thing in implementing change, it is simplicity and straightforwardness. We have outlived the dangerous period of 30 years ago when industrial arts had to be defended, explained and sold to educators and the general public.

It's legitimate, legal and acceptable. Why not just move ahead by accepting some goal or objective, make a choice of approach and move to the most important step – curriculum building – as fast as we can.

If I have over-simplified the problem, it is because simplification is a characteristic of mine. A continuation of the simple solution involves the matter of domains. After the three I described earlier were explained to me to a point where I understood what was meant, I realized that the talk was about method, outcome and content.

Curriculum building concerns only content (and, incidentally, regardless of level or school grade, to me the content of industrial arts remains the same). Outcomes are not a part of curriculum but merely the preface which describes what values are to be achieved from the study of subject matter, and method is an explanation of how subject matter is taught and, again, is not a part of curriculum design.

The point I am trying to make is this. Curriculum starts and ends with content. Once the content for a program of industrial arts is clearly identified and agreed upon, it can be arranged in a variety of ways to meet individual and school needs as well as be cut into usable pieces by grade level and by course.

I am concerned with the direction in which industrial arts is heading. Therefore, I would like to talk about three issues which, in my judgment, will be significant in the period ahead.

While I am sure that, given a little time, each of us can list dozens of issues in industrial arts today, there are three which are of particular concern to me. These include: Industrial arts as a school-centered program, industrial arts as occupational education, and the industrial arts program itself. I do not plan to discuss the first two fully, nor will I identify specific solutions for them. I will, however, delve more deeply into the third. Let me take them in order.

Industrial arts as a school-centered program. With the massive reorientation of occupational education, with the rapid development of vocational education programs to serve the needs of students in areas where occupational programs did not exist or were limited in terms of today's needs, and while there is talk of broadening occupational education programs and making them more general in many respects, it seems to me that there is a need for a clear position concerning industrial arts.

Industrial arts is, and has always been, accepted as a part of the general school program. Both small rural and large city schools provide industrial arts courses for their students. The organization of industrial arts is not dependent upon numbers of students as is the case with much of occupational education. The program does not require coordination within a region as does occupational education. On the other hand, it does require a continued identity with occupational education because many of the fundamental concepts relate directly to understanding the world of work and the selection, on the part of students, of future occupations.

If we adhere to the concept of industrial arts as a school-centered program, industrial arts will continue its fundamental and basic function in the educational program.

Industrial arts as occupational education. Now that I have taken a position that industrial arts is general education, let me move to the issue of whether industrial arts can be occupational in nature.

During all the years before there were significant numbers of occupational education programs, industrial arts, in terms of some of its highly developed, narrow courses, served as a substitute for occupational education. We should not say this was wrong, but rather that it occurred as an expedient when nothing else was available. With the current development of new vocational programs, the need for highly developed, narrow, occupationally-oriented industrial arts courses will be gone.

On the other hand, with the broadened concept of what occupational education ought to be, consideration must be given to the role industrial arts teachers and facilities may play in a total program of occupational education in a region. Here, I am not talking about the industrial arts curriculum. I am talking about the teacher and the facility and its use in planning a broad occupational program. There are many levels of occupations for which training can be provided in a home-school environment. The industrial arts teacher and his facility in the home-school are uniquely qualified to serve the occupational needs of certain students. The issue here is that what the industrial arts teacher and facility do as a part of occupational education must be clearly separate from the general program of industrial arts education. The two must remain separate and clearly distinct from each other. Each has a specific mission in the total educational scheme.

The industrial arts program itself. Let me turn now to the issue of the program of industrial arts education. The basic principles of industrial arts are still valid, and the basic methodology is still reasonable. Hidden in the profusion of individual courses now offered as a part of industrial arts, there is a basic content which is still fundamental for all students. It seems to me that we do not need studies and research to tell us what to do, but rather we need agreement that revision is necessary. We need agreement on what the over-all pattern of an industrial arts program should be, and I remind you that we do not have a program of industrial arts education; we have a collection of courses without a clearly defined set of sequential activities leading to one over-all goal. What we need is a massive curriculum effort to build a program based on an identifiable content, on a clearly-established set of understandings and principles, rather than on tools, materials and skill development. There is a sense of immediacy to accomplish a full and complete curriculum revision in industrial arts education, and it should not be a piecemeal revision, one which attacks only one level of the program at a time. Rather, there is need to start practically from scratch and design a program K-12 which clearly fulfills the needs of today's general education function.

With that as background, let me turn to a series of five principles which I believe can provide direct action and guidance in developing an improved industrial arts program.

The five statements say in essence that industrial arts as a school program is all-encompassing in terms of the population to be served, that it is still general education and a curriculum area unto itself, that it has but one goal or purpose, that its basic organizational structure must change, and that its basic methodology is still sound.

Industrial arts, as a program serving both boys and girls, men and women, extends from kindergarten through adult education. For too long, we have concentrated our efforts, expansion and even teacher education on the narrow confines of the six secondary school years. We have given lip service to an elementary program. True, there are some ex-

amples of industrial arts at the elementary level; however, these are but small lights in a vast darkness – barely able to be seen because of an overwhelming enrapture with grades 7 through 12.

While I would rather not delve into details of curriculum approach, one comment must be made. Industrial arts at the elementary level, to be successful, cannot be a watered down secondary program or "junior industrial arts". It must take its content from the rest of the elementary school curriculum.

At the other end of this scale – beyond grade 12 – we have provided teachers for the usual adult education courses in woodworking or ceramics or what have you, but nowhere do we have a planned set of experiences for adults based on industrial arts principles or objectives. At the adult level we should be offering planned instructional programs consistent with the basic concern of industrial arts and the needs of people.

I cannot emphasize too strongly the need for a commitment on the part of industrial arts educators to serve the full spectrum from kindergarten through adult.

Industrial arts must clearly be defined as a curriculum area without a direct relationship or involvement with other instructional programs. If we believe that industrial arts is good for some children, then we must take the position that industrial arts is good for all children and has a place in the total scheme of things.

There are aspects of a student's education which some people like to call academic or general and other aspects vocational or something else. Industrial arts has always been said to be part of general education. I agree with this position; but more importantly, it must be agreed upon by everyone.

The day industrial arts is promoted as preparation for employment or the development of salable skills, it can no longer be considered general and good for all. This is not to say that industrial arts cannot assist with the identification of occupational goals, as I indicated earlier; but this should not be its sole purpose for being. In order to be effective in the total educational scheme, industrial arts must be so structured and organized that it can stand alone as a subject area.

Every so often, someone will make statements that industrial arts can and should serve the other curriculum areas or that it reinforces the learning in other subjects or it provides practical application of science, math or social studies. While it is true that there needs to be a relationship among all fields of study so that all bear upon the totality of a student's experience, this does not mean that any must be subordinated in the process.

In terms of a relationship to vocational-industrial-technical education, the involvement is more critical. For too long, industrial arts courses have, at the senior high school level, substituted for vocational education because they were all that were available. Unless industrial arts education at the senior high school level is established as a clear and separate curriculum area with defensible purposes of its own, it is likely that much of what we now have in the upper secondary grades will disappear. Industrial arts is most vulnerable at this level, and clear definition is needed almost immediately.

The first and only goal for industrial arts is that of providing an understanding of American industry and an awareness of its changing technology. Industrial arts educators have been devising and revising objectives for decades. As I read lists from the AIAA, AVA, individual authors, our own department and other state education departments, the words are all about the same. In some, certain aspects are emphasized; in others, the emphasis may be on a particular activity or direction. What I believe we have at present in all these lists of "objectives" is a set of subpurposes or outcomes rather than a clear-cut objective or goal of a program.

Simplicity of approach could be of assistance in clarifying the situation. There should be one objective or goal for industrial arts, "to provide students with an understanding of American industry and an awareness of its changing technology." This statement is all-encompassing and is as applicable in the kindergarten as it may be at the adult level. Depending on your views or concepts, any number or combination of subpurposes can be written to amplify or give specific direction to a program.

Let me discuss for a moment one of the present "objectives" and attempt to put it into the simple framework I propose.

A degree of skill has been with us as an objective for as long as any of us can remember. It is a direct outgrowth of the use of tools and materials. There is a difference between understanding the necessity for skillful use of tools and machines and the development of skill in the use of tools and machines. On the one hand, a student uses tools to learn how they are used in industry and why high standards of use are necessary to the economy. In this case, the student may or may not develop a degree of skill – but he at

least has learned that skill is important. On the other hand, if the student is subjected to constant practice and the development of skills in order to become proficient in the use of tools, this no longer represents an industrial arts concept.

The point, however, is not to disclaim skill, but rather to indicate that under the broad goal of understanding American industry, the objective relating to skill, if handled as a matter of understanding, can be considered covered.

The same case can be made for such objectives as avocational interest (the shorter work week of industry can be the basis for including such development within the broad framework of the one goal or objective), exploration and problem-solving ability. If time permitted, a case could be made for each one's being a part of the fundamental goal.

One clear-cut, straightforward objective or goal must be agreed upon for industrial arts.

A program of industrial arts must be derived from an analysis of the major functions of industry. If one accepts the premise identified in the third point concerning one goal for industrial arts, then there must be an adjustment in the program orientation itself.

If industrial arts is to be considered a curriculum area without entanglements with other subject areas, particularly the vocational-industrial-technical area, then the present organizational pattern, firmly rooted in materials, must be replaced. No longer can we teach woodworking, metal working or even plastics. Rather, we must teach about American industry. Learning to use an assortment of tools and applying the "skills" so gained to project construction does not fully meet the objective of understanding American industry.

The content (subject matter if you will) must be derived from something other than six or seven materials or forces used in industry. The functions of industry – manufacturing, construction, communications, transportation, as examples – comprise a stronger base for producing the content of industrial arts education. I realize that many of you will say there is nothing new or startling in this position. And I will agree with you that it is not new. All that I am doing is making a choice among the many proposals advanced; and from where I sit, I'm willing to ride with this one.

When industrial arts started to be taken seriously in the early 1930's, there was a basic concern that the program should have a breadth representative of all aspects of industry. This laudable purpose (and I am not being facetious in any way) needed some base or rationale with which the concept of breadth could be established.

At that time, the best rationale was related to the materials classification of industry and in some ways followed the early development of manual training, where wood or metal was used as the basis for instruction. Breadth was developed by adding other materials such as ceramics, electricity, textiles and printing. The justification was found in the numbers of people employed in these industrial fields – and this was based on a still-used classification system for the manufacturing industries.

The resultant comprehensive general shop organization for industrial arts grew out of this concept of program content. Over the years, the comprehensive general shop pattern became nothing more than a six-ring circus of short periods of time devoted to instruction in each material area. Little attention was paid to utilizing the comprehensive general shop as a laboratory in which to study American industry – its methods, processes and functions. And this isn't very new either. Almost twenty years ago, a professor for whom I had great respect and admiration, the late Dr. Robert L. Thompson, enunciated this concept.

I use this bit of historical rambling to illustrate my concern that we ourselves have overlooked the one great value of the long-standing organizational structure of our facilities. This value is that the presently equipped general shop is ideally suited to a changed concept of instruction in industrial arts – one which is based on the goal of understanding American industry and whose content is organized in terms of the functions of industry rather than of the materials used in performing these functions.

All instructional resources, tools, machines, materials, manipulation and activity are to be considered as a means or method used in a classroom to implement efficiently and effectively the objective of understanding American industry.

I believe in a multi-media, multi-activity organization for industrial arts programs. The materials and processes of industry are necessary to accomplish the goal or objective I identified earlier.

I contend, however, that industrial arts educators have deified tools, materials and manipulation to a point where they overshadow and hide the basic concept of industrial arts. It is disturbing to see a course outline or syllabus listing a lesson entitled, "How

to Use a Crosscut Saw." Such a lesson should never exist in a course outline or syllabus because it is not content. This does not imply that students would not learn to use tools or materials, but I would compare it to learning addition in order to understand the concept of numbers. Can we not direct our thinking in the same way? Base our program on concepts derived from the objective, and clearly and honestly put tools, machines, materials, manipulation and activity in the proper perspective – as a means or method, rather than as the content.

The methodology of industrial arts is sound. It includes a host of experiences, including individual project construction, experimentation and research as well as group activities, such as mass-production experiences and cooperative projects. But these are only the methods of industrial arts, and each of them has stood the test of time. However, content is more important.

Content is the information which is imparted to students in order to achieve certain objectives and outcomes. As an example, the operation of planing wood is not content in itself. This operation is more reasonably classified as a method used to understand one way of shaping an industrial material. The content would be knowledge relating to the material's texture, function and durability as well as the principles involved in the operation, such as the wedge and shearing action. In addition, further understanding can be developed which relates to automatic processes and machine operations. The concept of industrial production is developed in part through hand planing of wood.

For industrial arts education to achieve and maintain its rightful place in the total educational experience of young people, it is still important to maintain work with tools and materials as the foundation of industrial arts. And just as important is the realization that this "work" must be kept within its proper perspective.

I have not dwelled to any great extent on details of how the five principles or concepts may be implemented. Rather, I have identified certain concerns regarding the direction for industrial arts education in the years ahead.

Where should we be going in industrial arts? I did not really come here tonight to bring specific ideas or concepts for innovative practices or to add more materials to the conglomerate compendium we now have.

My appeal for direction is more a matter of decision-making. Let's stop talking, stop going around in circles, stop inventing new words, make a choice, start clarifying our goals based on that choice, and complete an acceptable curriculum design.

Someone once said, "Children are helpless and we must, at any cost, be responsible for them, because we are their model and they are our hope." I would place the responsibility for a quality program squarely upon the shoulders of the industrial arts educators. This quality must be reflected in all elements of the industrial arts program, including teaching of a high caliber, standards of performance which reflect quality, content which is meaningful, student experiences which are purposeful and facilities which are appealing and serve to implement the program efficiently.

In order to achieve this quality and excellence, each industrial arts educator must realize that the job which he holds is an important one and the influence which he has upon his students is equal to that of any other teacher in the school. It is necessary, as well, for the industrial arts educator to believe sincerely that industrial arts education is as important to every student as the work which his colleagues offer. Next, there is a need for industrial arts educators to think in terms of a program which is based upon a recognized body of knowledge that is important for every student to know. The program must provide for students desirable learning experiences regardless of geographic location or personal teacher whim. It is lack of adherence to this concept which exposes industrial arts education to the tinge of mediocrity.

Abraham Lincoln said, "You cannot escape the responsibility of tomorrow by evading it today." Industrial arts educators can no longer evade their responsibilities to youth nor to their own consciences.

In order to provide a quality program and meet these responsibilities, industrial arts teachers must release themselves from the chains of tradition. They must have the vitality to work harder at their jobs and to learn new techniques when necessary. They must have an insatiable curiosity about technological changes in industry and the perseverance to search out ways of transmitting these new concepts to children. And, finally, they must have faith in the youth they teach, realizing that their capacities for learning are great and that they are capable of doing much more than we think they can.

A long time ago, so long ago that I cannot remember the origin of the statement, someone described industrial arts as "wooden in its teaching and iron in its rigidity." We all

know that description no longer fits our program, but there is much to be done and so little time left in which to do it.

Ferris Bryant, former governor of Florida, said, "We don't need a hot line to Moscow as much as we need a hot line to tomorrow."

How hot a line to tomorrow do you have?

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THE INTERFACE BETWEEN ENGINEERING AND INDUSTRIAL ARTS

Harold A. Foecke

Introduction

Thank you, Mr. Chairman, and ladies and gentlemen. The custom of applauding a speaker before his remarks is a consoling practice because one is never quite certain that there will be any applause at the end. This may be even more the case for me tonight, for I may feel obliged to say some things that might trouble or even offend some of you.

Because it is also customary for a speaker to assure his audience how delighted he is to have the opportunity to address them, I'm going to have to say a bit more than the usual to convince all of you how truly pleased I am to be here. I am told that the appearance of an engineer or engineering educator on the official program of your annual meetings is a relatively rare event; if so, I'm deeply honored and a little struck with awe that you should have selected me. As a matter of fact, since receiving the invitation of Professor Swanson, I have looked forward to this moment with undisguised enthusiasm. Indeed, I remember only one other occasion on which I have felt equally excited and challenged by a speaking engagement – and that was nearly two years ago when I told an assembly of engineering deans what you folks in industrial arts are doing. Many of them didn't like what they heard at all – which leads me to wonder about your reception of an engineering educator's view of industrial arts.

Before getting started, I want to acknowledge that for my appearance here tonight I can thank (and you can blame, if you wish) that resourceful, energetic and widely-known advocate of the cause of industrial arts within the US Office of Education – Dr. Marshall L. Schmitt. As a result of one of the seemingly never-ending reorganizations of the Office of Education, it was my privilege to be his supervisor for about 15 months during parts of 1964 and 1965. I learned a lot about industrial arts from him, and probably learned a little sales resistance along with it. It all began when he introduced himself to me and stated how glad he was that we would have a chance to work together because engineering and industrial arts have so much in common. In effect, my reply to him was, in all sincerity, "Marshall, you've got to be kidding". And that's how the battle (excuse me, the dialogue) began.

I feel that my task this evening is a delicate one. If communication is to be fruitful and useful, it must be candid; I hope that my remarks will be tactful as well. If something I say displeases you, don't be offended; I come as a friend (although you may say when it's over, "When you've got a friend like that, who needs enemies"). I want to help bring about more fruitful interaction between engineering and industrial arts. If I display areas of gross misunderstanding, please accept it in a kindly way as a symbol of what I believe to be the ocean of ignorance within engineering regarding the history, nature and activities of industrial arts.

Marshall Schmitt will confirm that at least I have tried to understand industrial arts. He used to bombard me with things to read, and I went through all of them in a painstaking manner, returning them to him with comments and questions penciled in the margins. In preparation for this talk, I reviewed such things as: (a) the 1961 publication of the Office of Education, Industrial Arts – An Analysis of 39 Curriculum Guides, (b) the conference report published in 1962 by the same agency, Improving Industrial Arts Teaching, (c) the survey report, Industrial Arts Education, published in 1966 and prepared by Dr. Schmitt, and (d) his article, "Learning the Arts of Industry", appearing in a 1966 issue of Ameri-

can Education. So, I've tried; if I still display an unbelievable degree of ignorance, teach me – don't tar and feather me. (I don't want any of you to get the impression that I'm apprehensive or anything, but those are my bags by the door, my plane ticket is in my pocket, and my sister and her husband are among you to whisk me away immediately after this talk.)

As a final introductory remark, I want to apologize in advance for what may appear to be any lack of precision and organization in my remarks. I accepted this assignment way back in January and was allowing what should have been ample time for the preparation of this paper. However, about a month ago I decided to accept a position on the headquarters staff of an international agency located in Europe, which among other things will involve the moving of a family of nine to a nation the language of which we do not yet speak. Not long after the aforementioned decision, my wife entered the hospital for some surgery and I wound up playing mother hen to our seven crumb crushers. Finally, six days ago I was involved in an automobile accident in which my Rambler wound up being declared a total loss. So, you see, I'm just mighty glad to be here – prepared or not.

Terminology Considerations

Where do we begin? First of all, I invite your attention to the wording of the title as it appears in your printed program. I am going to present AN engineering educator's view; I would not want to pretend to speak for all engineers or engineering educators (and I suspect that the feeling is mutual). I had intended to buttress some of the points I wish to make by conducting a little survey of how my fellow engineering deans view industrial arts – but that was before the roof fell in on my time schedule.

I also deliberately used the term "interface" to suggest that our respective fields do impinge upon each other, that at the boundaries there are possibilities of relationships, cooperation and interaction. I mention this because I suspect that some of my colleagues feel that engineering and industrial arts are worlds apart, or at least that there is no meaningful chance of joint activity.

Before I can discuss this interface and the possible relationships to it, it seems desirable to portray the separate domains and thereby to detect the boundaries. But, in order to describe engineering and industrial arts I must use terms that are so diversely used (and abused) by society today that, in order to insure effective communication, I feel that I must invest some precious moments in revealing how I use terms like science, technology, art, profession, etc. So, to these matters of terminology and semantics I devote this first part of my paper.

Turning first to the word "science", the term is used in both a broad and specific sense. In the broad sense, everything these days seems to have to be science or scientific; this seems to be an easy way of bestowing presumed dignity on almost any activity. For example, take the so-called science fairs that abound these days. I'm not a scientist but even I must cringe at the incredible assortment of projects that are permitted under this umbrella – ranging from projects which truly seek to learn something to exercises which involve little more than the mere construction (frequently not even neatly) of some gadget or circuit by slavishly following the directions found in Popular Mechanics or some other source. Then too we have the example of journalists and "science writers" (well-intentioned to be sure) who tend to tag as a "scientist" everyone associated with some complex undertaking (e.g., lauding a probe on the moon), blissfully independent of whether or not the individuals actually involved consider themselves scientists, engineers or technicians. As you can tell from the caustic vein of my comments, I think that the loose usage of the term "science" is regrettable but it's something with which we must live.

When I use the term "science", such as in this paper, I try to restrict myself to the more specific (and, I think more traditional) sense of science as an organized body of knowledge which helps us to understand (and thereby to predict and control) phenomena. This body of knowledge is continuously (and, at the present time, very rapidly) being expanded through a process of search (or, if you prefer, "research") called the scientific method – this leading to the discovery (not the creation) of the laws and principles which lie behind the things we experience and are puzzled about.

Science is motivated and propelled by man's natural curiosity, by his desire to know and to comprehend. Inasmuch as the scientist seeks the truth, endeavors to determine what is, science is necessarily objective, detached and impersonal (which is not intended in a pejorative sense). There is no science of individual and unique events; science by its nature is directed toward the general, to ever more comprehensive laws, to principles independent of time, or place, or the mood of the investigator.

I also find it convenient to distinguish between the natural sciences and applied sciences. Conventionally, natural science is the body of knowledge which helps us to understand nature and natural phenomena – which means such well-known fields as physics, astronomy, psychology, chemistry, etc. By contrast, the applied sciences are the growing bodies of knowledge that help us to understand man-made phenomena, that is, phenomena which are the result of man's deliberate intervention in nature, of his attempts to modify, shape and control his environment, of the use of his ingenuity and creativity in devising new and/or better ways of doing things.

Because these applied sciences are not as clearly recognized as the natural sciences, a few examples may be helpful. Thus, medical science is concerned with understanding and predicting the consequences of intervening in the processes of nature in order to promote physical health – with vaccines, surgery, drugs, ointments, etc. Educational science is the slowly developing body of knowledge which helps us better to anticipate the outcomes of man-made learning situations. Management science, also in its infancy, reveals the dynamic characteristics of efforts to organize and coordinate human endeavor to achieve some desired goal. And engineering science discloses the characteristics, properties and behavior of man-made devices, systems, structures and processes – amplifiers, heat exchangers, trusses, distillation columns, etc.

These applied sciences are also growing bodies of knowledge which are expanded through research because human ingenuity in devising better ways of getting things done is always outstripping our human understanding of why they work. Thus, aspirins perform a useful function for reasons which are far from fully understood, the aqueducts served their purpose long before fluid mechanics was understood, educators have long been successfully promoting learning without really understanding how the human organism learns, internal combustion engines did their job for years before people really understood what happens when a spark is released in a combustible mixture, and individuals have long managed enterprises without a scientific knowledge of how men interact in organizations.

Anticipating somewhat a point to be made later, these applied sciences are not to be confused with the areas of professional practice which they support. Thus, medical science is not the practice of medicine, educational science is not the same as the art of teaching, engineering science is not engineering, and management science is not the art of management. Although I have used only four examples of applied sciences, there are others which correspond to other professional areas (the meaning of "profession" is yet to be discussed).

I have also just introduced into my remarks the term "art", which perhaps requires less discussion than the term "science", but which certainly deserves to be contrasted with it. Unlike science, art has an intrinsically personal, human and subjective character. The artist displays something of himself in, leaves his imprint upon, his work – whether this be the fine arts or the applied arts. Art is not a deterministic undertaking (like two and two equals four); there are no obvious right and wrong answers. Art inescapably reveals and expresses human values and value systems; as has been said, "art is the signature of mankind". Art is necessarily concerned with the unique, with the particular, with "one of a kind".

The word "technology", like "science", seems to be saddled with usages in both a broad and a specific sense. An example of the broad meaning, which I also believe is relatively new, is embodied in expressions such as "our technological society", the "evils of technology", etc.

Technology in the specific sense is related to techniques (a word which shares the same origin), to methods, processes and procedures for getting things done (construction technology, printing technology, manufacturing technology, etc.). The concept "technology" also embraces what is frequently described as the "state of the art" – specific information on what can be done (achievable chemical purities, possible machining tolerances, accuracy of instrumentation, etc.), empirical data on materials, structures and systems, and knowledge of arbitrary standards and codes of practice. Technology is a wealth of practical knowledge about the way things get done, knowledge without which they wouldn't get done.

The final term I want to discuss before diving into a discussion of engineering and industrial arts is "profession". Here too there is both a broad and a specific sense. In the broadest sense, profession seems to mean essentially "non-amateur", to be any activity undertaken for monetary (or equivalent) gain. It is in this broad sense that we have in mind when we joke about what is alleged to be the "oldest profession", or the

second oldest (which you can understand has to be advertising).

When I use the term "profession", as in this paper, it is in a very restricted sense. In my view, members of professions are those to whom society turns for trustworthy advice on what to do in important areas of human concern. When the lives of human beings are directly and deeply affected by recommendations upon which they are almost necessarily incapable of passing competent judgment, then hopefully they can depend upon the integrity, competence and responsible judgment of those who make these recommendations.

Thus, when the physician recommends to a patient the amputation of a limb to improve the chances of saving his life, when a lawyer advises a citizen on how to plead before the bar of justice in order to protect his person and property, when the minister suggests to a member of his congregation certain practices to improve his spiritual health and peace of soul, when an educator advises a learner about a program of studies suitable for his intellectual growth and development, when a psychiatrist proposes to a disturbed individual certain therapy to improve his mental health, in all of these cases the "client" should be able to assume that the recommendation is a responsible and ethical professional judgment based both upon experience and upon knowledge of the relevant natural and applied sciences and that he can therefore have confidence in the advice given.

From the above one can infer certain characteristics of the professions. First of all, it must be concerned with some fundamental or important human need or desire. Someone who advises me regarding my health or freedom could be a member of a profession; someone who suggests that I wear different colored socks probably would not be.

Secondly, members of professions operate at the pinnacle of activity in any given area and their overall recommendations are therefore subject to competent critique and review only by their peers. One might ask a physician to determine whether or not a nurse has performed her duties correctly, as one might ask an engineer to pass judgment on the work of a technician. But, if one feels uneasy about the advice of a physician, there is no place to turn except to another physician (not to a nurse, or a geologist, or a theologian); for alternative legal advice, one can go only to another lawyer, etc. To be sure, a scientist (such as a virologist) might point out to a physician how some relevant scientific principle in his field has been ignored or misused (and he could therefore tell the physician what he should not have done) but he cannot (in his role as virologist) devise alternative medical recommendations.

Third, the client must be given advice, not direction; he must remain free to seek or not to seek the advice of a particular professional practitioner, and free to accept or reject the advice received. Thus, the patient must have the right to risk death if he likes (provided important rights of others are not infringed), the client should be free to reject legal advice, a community should be free to decide not to fluoridate its water in spite of any unanimity of medical advice, etc. The alternative would be a kind of professional tyranny which seems wholly incompatible with the notion of a free society. Lord protect us from the day when we would be compelled to do as our educators, lawyers, engineers, physicians, etc., advise us.

The professional practitioner must also be free – free from any forms of compulsion which might coerce and/or tempt him into making recommendations which are not in accordance with his true and unfettered professional judgment. This means in particular that the professional man must be free of the possibility of either diminishing or increasing his income on the basis of what recommendations he might give. Who would trust the advice of someone who might be subject to loss of his job just because his recommendations happen not to be in accordance with those of his "employer"? Contrariwise, how uneasy would a client be if he felt that the professional man stood to profit more from one kind of advice than another (as a physician owning a controlling interest in a drug firm)? So, both the client and the professional practitioner must be free.

As a concluding note on the discussion of a profession, not everything that a lawyer, or physician, or engineer might happen to do is necessarily an essential part of his professional activity. Indeed, the essence resides in the tough decision – based upon all relevant facts, principles and circumstances – as to what should be done, in the devising of some strategy, plan or course of action; everything else is secondary. Deciding upon the recommended form of treatment is the crux of medical practice; skills in dressing wounds, performing surgery and giving injections are subordinate activities. Deciding upon legal strategy is the heart of the matter; degrees of eloquence before a jury are matters of secondary importance. In numerous professional areas, many of the activities associated with the execution of a plan of action can properly be shared with skilled sup-

port personnel (nurses, technicians, secretaries, etc.).

The Nature of Engineering

Having indulged in a detailed consideration of terminology, I am now prepared to advance my view of what engineering is and is not. First of all, if ever there was a much abused term in our society, I think "engineering" is it. As a matter of fact, I defy anyone to find a concept of engineering which is sufficiently broad and elastic to embrace all the uses of the term which one could dredge up from the literature of our society. Were one to try to define engineering on the basis of current usage, he would find nothing meaningful as a common thread or notion.

Some feel that part of the problem resides in the fact that the engineering profession (if such it be) has no real control over the usage of the term. Virtually anyone with the guts to do so can stand up and call himself an engineer and get away with it. Also, employers sometimes bestow this term upon their workers for motives quite unrelated to any philosophy of engineering (e.g., as "psychic income" in lieu of more tangible forms of remuneration).

A more fundamental aspect of the problem, in my opinion, is the fact that the engineering profession itself lacks unity in many ways, including the vital matter of what engineering really is (which, apart from any other considerations, is one reason why neither I nor anyone else can claim to speak for the engineering profession). There is no agreement on who should and should not have the right to say who is and who is not an engineer, much less upon the criteria which should be used. Should one decide on the basis of what an individual was "educated as", or what he is "working as", or what he is "labelled as", or some combination of these?

I think that a good example of the lack of a widely accepted concept of engineering within the profession itself is a recently published report entitled Goals of Engineering Education – the result of a nationwide, four-year, NSF-financed study of the subject. One might naively expect that the goals of something like engineering education would be shown to be related to (and in part derived from) the nature of engineering, but one seeks in vain throughout the report for a forthright treatment of this matter. I was only rather indirectly related to the production of that report (listed as a "consultant"), but I think I was close enough to the operation to say that the nature of engineering was not carefully presented because it would not have been possible to reach agreement on such a section. Right now there is much ferment (and some turmoil) within engineering and engineering education, and this necessarily affects any interface with industrial arts.

For myself, I do not hesitate at least to attempt to state in clear and operational terms what engineering is. However, if you are hoping to learn from me anything about how to relate better to the world of roughly a million individuals who call themselves engineers, I must warn you that a strict application of my notion of engineering would probably exclude about 90% of this group. So, I obviously do not speak for the engineering profession; I can only hope that you will find in my views sufficient logic and coherence to make these ideas useful to you.

In briefest summary, and in terms of the words discussed in the preceding section – engineering is not science, it is not technology; it is an art and a profession. To begin expanding on this, I would suggest to you that the purpose of engineering, the whole excuse for its existence, is to help society find better ways of satisfying certain human needs. To explain the underlined terms, "society" might mean individual clients, or private firms ("corporate clients"), or public agencies (such as a city government). "Better" means improved in an overall sense, when all relevant factors are considered according to their relative importance – not only technical factors (size, efficiency, speed, accuracy, etc.) but non-technical as well (beauty, legality, economy, safety, etc.). By certain "human needs" I refer to needs (or desires) for ever better forms of transportation, communication, energy conversion and distribution, nutrition, protection, recreation, production, investigation, etc.

Engineers have long used adjectives which haven't been very useful to a public that might want to understand what engineering is all about, what it really exists for. Adjectives like chemical, geological, metallurgical and aeronautical disclose the field of natural science upon which that particular area of engineering heavily depends. Adjectives like mining, welding, refining and construction denote some process with which an engineer may be concerned. Other adjectives denote a product – textile, petroleum, materials, etc. There are "geographical adjectives" such as space or ocean. There is no need to catalogue all of the various categories into which engineering adjectives could be

classified; the point is that only recently is there coming into prominence a category of adjectives which reveal more directly what engineering is all about – transportation engineering, communication engineering, etc.

As already indicated, the engineer advises his "client" on the best course of action, on what should be done. Understanding the process by which such recommendations are reached is revealing and includes the following steps in one way or another:

1. Clarifying the need or problem – engineering clients like medical patients frequently bring in rather vaguely defined needs, goals or "discomforts"; an essential step in any solution is a determination of the specific characteristics of the problem (lest one solve a problem which the client really doesn't have).
2. Identifying all of the factors which have a bearing on the solution – this would include:
   a. an inventory of all of the resources and/or limitations which might exist – such things as availability of funds, materials, energy, personnel, time, etc.
   b. applicable principles of the natural and engineering sciences
   c. relevant technological information – state of the art, codes, techniques, etc.
   d. important non-technical considerations – economic, legal, ethical, esthetic, cultural, etc.
3. Devising the optimum solution – achieving that balance which best accounts for the various competing criteria; this is the core of the process, the step in which creativity and ingenuity are exercised, where inventions are made, where breakthroughs occur.
4. Checking the solution – using analytical and/or experimental methods, "closing the loop" on the process by determining whether the solution does in fact meet the specifications established in the first step (and if not, cycling through the process as often as necessary).

The above steps I would call the "professional method" (because I believe that all activities that I would regard as professions follow this same basic pattern); many of my engineering colleagues would at least call it the "engineering method" (as contrasted with the "scientific method").

This brings me to my next point, viz., that engineering is not science (nor a part of science) anymore than medicine, the ministry, education or management are sciences. They all depend upon one or more sciences (engineering depends predominantly upon the mathematical, physical and life sciences; medicine on the biological and life sciences; management on the behavioral and social sciences; the ministry on the "sacred science" of theology; education on psychology and the behavioral sciences), but this is not the same thing as being a science.

Consider the following contrasts between engineering and science. First of all, they use different methods, one the engineering method, the other the scientific method, this being a contrast between creation and discovery, between design and research, between synthesis and analysis. As the eminent engineer-scientist Dr. Theodore von Karman, the first recipient of the American Medal of Science, said, "The scientist discovers what is, the engineer creates what has not been."

The scientist endeavors to determine what is; the engineer tries to decide what should be. As such, the scientist pursues the true, the engineer seeks the good (in the sense of a best course of action). Because the reality which the scientist tries to understand is independent of whether we like it or not, and because scientific truths are neutral (neither good nor bad in themselves), the scientist as scientist works in a morally neutral area and has no direct responsibility to society. On the other hand, because the engineer tries to determine what should be done, because he seeks the good, he has as engineer a direct and inescapable responsibility to society for the effects of his work. For these same reasons, engineering is a profession, science is not.

The scientist moves from the particular to the general, to discover relationships among previously isolated phenomena, to find laws and principles of ever-wider applicability (independent of circumstances of time, place, or anything else). By contrast, the engineer must proceed from the general to the particular, must apply the universal principles of science to the very specific and unique conditions of the problem at hand (and, by the way, if the problem is not really unique in some essential way, if an applicable prototype solution already exists, it isn't an engineering problem but only a technical problem).

The activity of science is sustained by human curiosity, by a natural and insatiable

des f the human mind to know, and because the secrets of nature seem inexhaustible, there is no foreseeable end to scientific activity. On the other hand, the activity of engineering is propelled by mankind's desire for better ways of achieving certain needs (transportation, communication, etc.), and because the desire for such improvements is probably as old as man and destined always to be a part of his nature, there is likewise no conceivable termination to the activity of engineering.

As already stated, the scientist seeks truth and/or certitude; he asks questions which eventually lead to verification or denial, to yes or no, to true or false. The engineer, in trying to determine what should be, what is best in a particular set of circumstances, is inescapably involved in value systems, which of course do not lend themselves to scientific certitude but rather become matters of individual and professional judgment. For these reasons, and because the engineer de with the unique and the particular, engineering is an art, not a science.

Let me also say, although not quite so exhau tively, that, in my opinion, engineering is not technology either. The engineer needs and uses technology, as he needs and uses science, but that certainly doesn't mean t ineering is technology, or vice versa. The more technological information an engin s at his command, the better his solutions are likely to be, but he cannot master of it, any more than he can comprehend all fields of science. Rather than usurp the role of the technologist (who can do many things better than the engineer), the engineer should respect and rely upon the competence of the technologist.

If in the foregoing description of the engineer and engineering you do not recognize the guy who lives two houses down the street from you and calls himself an engineer, don't feel too badly; he probably wouldn't recognize himself either. Those who don't fit my admittedly narrow definition of engineering but who call themselves engineers I would divide into three other categories: (a) engineering scientists (who do research on existing devices, systems and structures rather than designing new and better ones), (b) engineering technologists (who do technical design rather than creative or original design), and (c) a miscellaneous group who call themselves engineers largely because they got a degree in it once upon a time but who have used this background as a springboard into a variety of rewarding and useful undertakings (sales, management, technical writing, etc.).

What Industrial Arts Seems to Be

In the preceding section, despite the fact that perhaps 90% of those who call themselves engineers might disagree with at least some part of my highly specific use of the term "engineering", I dared to stick my neck out a bit and pontificate on what I think the nature of engineering to be. In this section, when discussing industrial arts, I do not have the same temerity and therefore aspire only to indicate "what industrial arts seems to be".

How does industrial arts appear to a typical engineering educator? I'm not sure, but if my own ignorance of four years ago is any indication, I suspect that most of them regard it as essentially the same as, or a part of vocational education. (How's that for openers? Doesn't that delight you?) What is more, I believe that most engineering educators care very little about industrial arts – not necessarily for snobbish reasons (although a few may feel that way) but simply because they feel it's practically in another world.

As I mentioned earlier, Marshall Schmitt used to tell me that high school industrial arts was a good preparation for a college engineering program. If engineering educators agreed, you'd think that some of them would explicitly mention industrial arts in outlining in their school catalogs the college entrance requirements for engineering. Yet I never recall seeing an engineering catalog that even specifically mentioned industrial arts, much less recommended it. I think that few, if any, even make reference to mechanical drawing. They usually specify the number of hours of English, science, mathematics, social studies and maybe foreign language, and then allow one or two unspecified units (which can be almost anything – typing, industrial arts, etc.). So, I suspect that many, if not most, of my fellow engineering educators would say that there is no meaningful interface between industrial arts and engineering.

But then, they haven't had the privilege of having Dr. Schmitt as a subordinate and personal tutor, so let me attempt to recite a little of what I think I've learned. I shall be cautious and interleave tentative conclusions with hesitant assumptions and sincere questions.

Perhaps the first thing I learned is the desirability of distinguishing between the natures and purposes of industrial arts education and vocational education. Am I correct

in believing that you are more concerned with helping students understand our modern world than with developing specific skills? If so, this makes sense to me and it probably would become even more meaningful if I had more chances to see your programs in action side by side with vocational education. However, on this point, the course titles which appear in your literature don't reassure me too much, nor does the published results of the survey of industrial arts education which indicates that not only principals but industrial arts teachers as well gave the highest overall rating to a skill objective.

Another tentative conclusion I have come to is that those whom you regard (or who would regard themselves) as regular members of what you call the industrial arts profession are largely located in education at one level or another. Whereas only a small fraction of engineers are in education, is it not true that the proportions are approximately reversed for industrial arts? By the way, you may have noted in the opening sentence of this paragraph that I did not admit that industrial arts is a profession. It may seem that I am going out of my road to be obnoxious, but I suspect that you will agree that industrial arts would not satisfy my criteria for a profession (which doesn't mean a darn thing if you don't accept my definition of a profession, which is your prerogative of course).

The earlier mention of objectives reminds me of the constant difficulty I've had in figuring out what your objectives really are, what you most want to accomplish. Some of your statements of objectives seem to be rather long litanies of obviously desirable things, but I looked without success for some few really key objectives among the others which are doubtless worthy but perhaps secondary in importance.

A related problem, which might be eliminated if I examined some curriculum guides, is the need for objectives stated in sufficiently operational terms so that one can figure out how to determine whether or not the goals are being achieved. All of education is plagued with this problem; we educators are particularly prone to declare ourselves in favor of objectives which are both unassailable and unfortunately unverifiable, objectives which are the pedagogical counterpart of being in favor of motherhood and against sin. Then, after experiencing the catharsis of making this verbal obeisance to the pedagogical gods, we forget all about our lofty and pious pronouncements and descend directly to the nitty-gritty of playing checkers with the curriculum and lesson plans. History teachers talk about helping students understand our heritage but their lesson plans and tests reveal a preoccupation with dust-dry facts; language is supposed to help us understand another culture but it looks to an outsider like conjugation of the pluperfect tense in the subjunctive mood; science teachers say they want students to learn the scientific method but it appears to the students as memorization of formulas, etc. I couldn't help wondering as I read your literature how vulnerable you may or may not be to this rather widespread educational failing. Does day-to-day industrial arts teaching really reflect your professed objectives?

Another tentative conclusion I would ask you to verify is my inclusion, in your sphere of responsibility, of the 4-year industrial technology programs which have been emerging (mostly since World War II I gather) at the college level. If this be so, what are the presumed career objectives and actual career patterns of those who major in such programs? With what technical organizations will the graduates of these programs be identifying themselves if not with the AIAA? If at the high school level you wish primarily to be a recognized part of general education and appeal somewhat to all students, is this also true at the collegiate level? Or do you have a somewhat heavier career focus at the college level? And what would the career be? "Technology"? As you define it? As scientists and engineers use it? Or what?

Mention of your students and graduates reminds me that I still have not read widely enough to encounter the volume of information I'd like on what paths are taken by students who take a generous portion of industrial arts in high school. How many go on to college? Of these, how many take engineering? Engineering technology? Industrial technology? With what degrees of success?

Maybe I should close this attempt to reveal my combination of knowledge and ignorance by mentioning what I regard as the most striking possible example of the communications gap (indeed gulf) between our fields of industrial arts and engineering, viz., the emergence since 1963 of a high-school-level course promoted by engineers, called the "Engineering Concepts Course", and using a specially written book called The Man-Made World.

I read in your literature that a long-standing objective of your decades of educational efforts has been acquainting all students with the role of technology in today's world and yet I read in a recent report of this new project that this new ECCP course "is an attempt

to provide the high school student with an understanding of the impact of technology on today's world". Elsewhere I read: "Technology is among the least understood by the man on the street. If technology's benefits are to outweigh its liabilities, the public must exert an informed influence, an influence that can only come through an awareness of technical principles." Elsewhere the reader is assured that the course is "aimed at the general student body", is a valuable part of general education. All of this could have been lifted right out of your literature. The engineers also say that the course offers an alternative approach to pure science, one that will tie the physical principles to the man-made world, tie them in with the study of systems, devices and processes that man has created to cope with nature. Automatically, this approach would place emphasis on the influence of technology in creating our modern environment. Does it sound like something you might have written?

Please don't regard this project as an act of war on the part of engineers, invading what so clearly you have regarded as your province at the high school level. They meant no harm. The sad fact is that they probably weren't even aware that they were invading your domain. Whatever the case may be, surely it indicates a need for more dialogue – starting now.

Comments Regarding Interface Activities

Now, what about the interface, and possible areas of cooperation. What was most exciting to me as I have listened to Marshall Schmitt and read some of your literature was the presence in your total operation (in what minute proportions I do not care) of open-ended projects – where students start out with some human need to be fulfilled, some objective to be achieved, and proceed to figure out the best way to get the job done. I remember hearing him tell me of a project in which students had to devise a container in which an egg could be placed and then dropped 50 feet and still have the egg be recovered unbroken. Anyone who thinks such a problem is contrived and artificial just doesn't know about the challenge of shipping delicate missile components around USA via the mails or regular freight.

In any event, it is great to see students gain experience on problems with no obvious right answers, problems which are better solved the more science and technology one knows, problems with non-technical features, problems with competitive criteria that require judgment. Engineering education is only now awakening to the importance of these realistic experiences. If you could help students detect and foster their ingenuity and creativity in this way, it would be a very direct form of healthy interaction with engineering. I suspect you would have no difficulty getting engineering educators to work with you on this.

It might be hard to take such a project-centered course and achieve very much by way of a broad understanding of our technological culture, but don't worry about that. You would be giving all students, whether they went on to engineering or not, a very valuable experience in making judgments, in following the pattern by which all professions (as I define them) proceed in making decisions. You could therefore indirectly benefit all the professions which draw upon science and technology in order to advise society on courses of action. Good science courses will teach the student to be analytical, reveal to him how scientists proceed to determine <u>what is</u>. Missing is the converse kind of experience which helps students see how to determine <u>what should be</u>.

This leads me to a second suggestion – which would affect engineering less directly but might help you modify the image you have. Unless I misunderstand, an important part of your philosophy of teaching is learning through doing something with the hands. I trust that this is a treasured part of your heritage which, as one of your articles tells me, gradually evolved from "manual training", to "manual arts", to "industrial arts". But your emphasis on your cultural and general education role may not be as ancient. May I respectfully suggest that if you want to achieve an "appreciation of technology", that you experiment with various educational strategies rather than upon a single path.

Let me employ a parallel. At the college level there are such courses as "art appreciation", "music appreciation", etc. They usually don't try to teach music appreciation by asking students to compose something (although maybe they should). There are actually three kinds of objectives and types of learning experiences – for "the appreciators", "the performers" and "the creators". The skill in playing an instrument is developed differently from an appreciation of music – and neither of these necessarily test your abilities as a composer.

So, would it be too far fetched to ask you to consider once again just what you are

trying to do? Teach an appreciation of technology? Teach technological skills (the performers of existing technology)? Or develop the creators of new technology? Or all three? If all three, whether you don't need a bigger variety of teaching strategies? As a matter of fact, as an over-simplification, I wonder if the following doesn't apply: (a) you profess to want most to teach appreciators, (b) you are actually turning out the performers, and (c) maybe you should be focusing on the creators.

Regarding the invasion of the high school level by engineers, I suggest that you study what they are up to, borrow ideas that you find valuable, use this development as a goad to speed any reforms you have in mind, and remain optimistic about the eventual failure of this venture. I don't want to chronicle what I think to be their faults and blind spots, but I think there are enough to forestall any whirlwind success. But, it is a sign that not everyone was aware of your objectives (or else that they felt you weren't achieving them).

At the college level, the emergence of your four-year technology programs has certainly served as a stimulus to engineers and engineering technologists. They felt you were invading their sanctuary – and my speech in Denver in 1966 tugged the security blankets of a goodly number of them. At the college level, I suggest that you identify the purpose of your industrial technology programs to be the preparation of high-level technologists, that you work for eventual coordination and merger with engineering technology, and that both fields drop their preoccupation with their respective adjectives – industrial and engineering. Technology is a field in its own right and recognition of this will be speeded by dropping old adjectives. If adjectives are needed, let them be more descriptive of the related function or process – construction technology, production technology, etc.

May I also be so brash as to suggest that the adjective "industrial" is going to be an increasingly big liability even at the high school level. If your terminology has evolved from "manual training", to "manual arts", to "industrial arts", further evolutions to "applied arts" might be worthy.

Unless you talk about industry in an exceedingly broad way (banking industry, educational industry, hospital industry, etc.), which may be hard to sell, you are going to find yourself hard put to broaden your sphere to all areas of endeavor in which human ingenuity is used to devise technologies which benefit mankind. Industry, with its mass production, has been a giant on the modern scene. But don't let this fact fence you in.

I hope that these thoughts and suggestions can be the beginning of further dialogue between engineering and industrial arts. If I've not alienated all of you and worn out my welcome, or made myself too inaccessible by relocating in Paris, I would deem it a privilege to be a part of any future exchanges.

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General Session VI
Presiding, Ralph C. Bohn; Greetings, Marshall J. Diebold; Introducer, Harold G. Gilbert; Speaker, William J. Micheels; Rec., George J. Brown; Hosts, Oliver Agerlie, L. H. Bengston.

NEW CONCEPTS IN EVALUATING STUDENT PROGRESS

William J. Micheels

At the outset, I think it is pertinent to use an old favorite in setting the stage for my remarks. I refer to an anecdote from Alice in Wonderland. In this instance the Cat had just finished telling Alice that in going in either direction she would run into mad people.

"But I don't want to go among mad people," Alice remarked.

"Oh, you can't help that," said the Cat. "We're all mad here. I'm mad. You're mad."

"How do you know I'm mad?" said Alice.

"You must be," said the Cat, "or you wouldn't have come here."

During the past several weeks I have wondered many times about the state of my mental health for accepting the invitation to prepare this paper. To begin with, if I were perfectly frank I would have to say that I do not know of any really "new" concepts in the evaluation of student progress. However, I am aware of some new and exciting developments in student evaluation. Furthermore, the word "concept" bothers me a bit, but I do not want to get bogged down in trying to define what the term means.

So . . . the concepts I wish to dwell upon in this paper may be concepts or sub-concepts, or sub-sub-concepts. I will leave the determination to you.

Also, in my thinking and outlining I have found it difficult to categorize the topics I have chosen into neat little packets which are mutually exclusive and still related to the central theme. Some of the topics kept popping up. When I finally sat down to write, it was in the context of another anecdote from "Alice". Again, she was talking to the cat.

"Cheshire-Puss," she began, "would you tell me please which way I ought to go from here?"

"That depends a good deal on where you want to get to," said the Cat.

"I don't much care where--" said Alice.

"Then it doesn't matter which way you go," said the Cat.

"--so long as I get somewhere," Alice added as an explanation.

"Oh, you're sure to do that if you only walk long enough," said the Cat.

So I started out walking (on paper).

Now that I am a university president, several years removed from day-to-day teaching, perhaps a further explanation or admission is in order. This can best be done by telling you about the physician, lawyer and university president who were having one of those rare evenings together, as friends, when they didn't have to talk business.

The conversation got around to the subject of the creation and the wonder of it all. The discussion got around to the wonderful way in which the Lord began with chaos and out of this came the creation, with Adam and Eve, Cain and Abel, and so on.

As they were pondering and discussing, the physician spoke up saying, "This was indeed a wonderful event and it makes me even prouder of my profession. Did you ever stop to consider with the use of Adam's rib this was the first instance of a surgical operation? Yes, mine is an ancient and honorable profession."

The lawyer replied almost immediately, "Yes, mine is an ancient and honorable profession also when you consider that after Cain slew Abel we had the first instance of a murder trial."

The university president let them glory in their professions for a few minutes, but then he said, "All of this may be very fine, gentlemen, but who do you think created chaos in the first place?"

With these several defenses in mind, we can proceed with the paper. (Along the way you will notice that I make very few references to industrial arts as such. This is to come in the follow-up sessions.)

To begin with, I would say the most significant emerging concept is neither new nor startling, but it is different and exciting. It represents a distinct change in focus and an intriguing potential for development.

I refer to the definite shift from norm-based evaluation to criterion-based evaluation.

Stripped of its jargon, this means that we are moving away from a sole reliance on marks based on a comparison of each student with all other students in the class or group. Moving into the educational scene is a type of evaluation which tells how well the student is performing in terms of a known standard with little or no relationship to the performance of his fellow students. He can be compared to other students, but this is not the basis for recording his achievement.

Criterion-based evaluation is not something new. It is already with us. It has been used in areas where rather refined units of measurement are available. Simple examples are the track and field sports, or typewriting and shorthand. The individual is able to run a certain distance in so many minutes or seconds. He jumps or throws so many feet and inches. He types or takes shorthand at so many words per minute. He is measured in terms of specified criteria.

The criterion-reference score indicates the degree of proficiency achieved by an individual without reference to anyone else. Whatever class he is in, or whoever else is in the class, his score is the same and indicates his level of proficiency. Also, expected standards can be expressed in terms of meaningful levels of proficiency. For example: as a result of the learning experiences in a class, we expect a student to be able to type 50 words per minute. Some students will take longer and some will require more help,

but the goal toward which each is striving becomes clear, and the evaluation proceeds on an individual basis.

In many subjects it is more difficult, but not impossible, to establish similar criteria or proficiency. This is where the intriguing potential for development comes in. We have a long way to go, but we must learn how to get there.

This new development of criterion-referenced evaluation has been thrust upon us by the new demands for doing something new about the old idea of individualized instruction. This, at a time when more and more people have to be educated, in less and less time.

Such terms as modular or flexible scheduling, programmed instruction, individualized learning packages and computer-assisted instruction (CAI) are indicative of the attempts being made to realize the ideal of individual instruction on a mass basis. This requires the establishment of goals on a basis of individual proficiency rather than in terms of group comparison. To paraphrase the thought of one writer, "Since the heyday of Thorndike we have been learning more and more about groups and averages, and less and less about individuals; now the worm is turning."

With this emerging concept as the basic thrust of this paper, let us try to take it apart by examining some of the causes, effects and problems involved.

A good place to start is to consider the four imperatives which J. Lloyd Trump has set forth for the improvement of secondary education (they have relevance for elementary and higher education as well).(1) He says that the first imperative is to change the nature of teacher presentations. Teachers spend half of the time talking to students. This is not right, he says. Dr. Trump states that there are only three appropriate "talking" activities: to motivate, to provide information not readily available to students elsewhere, and to make assignment · "The teacher's goal is not to cover the subject, but rather to get the students to do s

The second imperative is to change the character of independent study. He is talking here about what the students do after the teacher has finished talking. The goal is to reduce teacher supervision, in order to develop more pupil responsibility. This has important implications for independent or self-evaluation, which we will be discussing later.

The third imperative is to provide for better student discussions. The purpose is not to cover the subject, nor to rehash teacher presentations. The emphasis is on good discussion and improved interpersonal relations. The inferences for improved evaluation relate to the ability of the instructor to make candid and meaningful observations as the students learn how to evaluate and improve their discussion techniques.

The fourth imperative is to change the process of evaluation. Dr. Trump says he wishes to be very dogmatic in suggesting that three present practices need to be abandoned immediately. "The first practice to eliminate is the oral quiz, erroneously called classroom discussion.... The second practice to be abandoned is the use of multi-purpose letter grades – that is, the A, B, C, D or F, or whatever equivalent you use – that combine such unrelated matters as achievement, attitude, personality... or whatever else the teacher wants to include... The third practice to abandon is emphasis on the comparison of individual pupils in groups. Included are such activities as grading on a curve and preparing class ranks."

Dr. Trump is more detailed in discussing his imperatives and the implications growing out of them. My purpose was to summarize his thinking very briefly to illustrate the kinds of changes which leaders are talking about and which have definite implications in terms of the criterion-based type of evaluation we are exploring.

When one tries to summarize numerous articles of this kind, a conclusion can be stated very bluntly: Many teachers, especially in high schools and colleges, put more time and energy into "sorting" and "grading" students than they put into teaching them. Grading-by-comparison is institutionally imbedded in the childkeeping-bookkeeping practices of our schools. It is the administrative language that propels a student from class to class, from school to school, and from school to college.(2)

In this connection we might spend much time in discussing grades or marks. They certainly are an important part of the present educational process. And, of course, marks have their place, such as it is. They represent a teacher's evaluation of a student's performance. They are used to indicate those who are designated for promotion and non-promotion. They provide data for academic and vocational counseling. They are used (presumably) to reward good performance and punish poor performance, to motivate learning, to communicate with the home, and so on.

Each of these uses might be amplified and perhaps challenged, but I do not wish to take the time to do so here. There would be little "new" in what I would say. Marks will

be with us for some time to come. We do not yet know enough to go about the process of abolishing marks, but I hope that some of the developments being reviewed in this paper might point the way whereby we can reduce their unwholesome influence by employing different forms of appraisal. When that time comes, as one writer states, "Specious grades and hollow examinations will be considered as educational monstrosities."

I would like to dispose of the topic of marks and marking by saying that "there is no other field about which so much has been done and concerning which so little is known." But there are some hopeful signs on the horizon.

Which brings us back to the matter of criterion-based evaluation, wherein we wish to provide meaningful scores to indicate the individual's level of proficiency in whatever it is he may be studying. Before going very far in this direction, a first question becomes obvious. Just what are the students expected to learn? What are the objectives? This may be one of the most important reasons for moving toward criterion-based evaluation. We are forced to take a careful look at objectives.

This is an area that has long been of interest and concern to me. We have talked and written so much, but we still know so little. In preparing for this paper I reviewed several others I have written on the topic, including one in 1952 called "Functional Objectives". I still think it was a good paper, but, to paraphrase Mark Twain's comments on the weather: "Everybody talks about defining objectives, but almost nobody does anything about it."

There are heartening signs that some breakthroughs will likely be made, but the lights are still very dim.

Henry S. Dyer, of the Educational Testing Service, in writing on the "Discovery and Development of Educational Goals(4), began his essay by pointing out that "practically every major philosopher, from Confucius and Plato and Aristotle down to Whitehead and Russell and Dewey, has had a good deal to say about the aims of education and its function in society. . . . No less than two Presidential Commissions have taken a crack at the problem. . ." After listing various other recent statements of goals, he concludes that the question is still very much open. In his words, "The problem of goals is today more than ever a top priority and largely unsolved problem. . .

"The trouble is that in spite of all the hard thinking and earnest talk about educational goals and how to define them, the goals produced have been essentially nonfunctional – and I mean even when they have come clothed in the so-called 'behavioral terms' we so much admire."

Whether or not this reconsideration of objectives (in terms of process and product) is new, it is the most important problem facing educators today. Perhaps you think this is a strong statement, but I will stand by it. Until we learn how to describe in meaningful terms (and there are several sub-concepts to the word "meaningful") the outcomes or behaviors which we expect individual students to achieve, the breakthroughs of which we dream will not be possible.

This is an oversimplified statement and there are other factors to be considered, but the deliberation, determination, delineation and definition of objectives is the important first step because it involves philosophy, psychology, methodology, along with foresight, insight and damned hard work. It is a new concept of evaluation (with an old foundation) with which each of us in this room needs to become much more sophisticated. If any of you is looking for a breakthrough area into which you could put your very best professional efforts, take a close, hard look at what needs to be done about this matter of objectives.

About now, some of you are saying to yourselves, "Here we go again. We've been talking about objectives ever since we started in college. Why do we have to bother again? Furthermore, we're talking about evaluation. According to the books, objectives come first – evaluation comes last." That may be one of our problems. We fail to perceive that objectives and evaluation should be practically one and the same.

To use different words: When you are able to invent ways to solve the problems relating to objectives, you will have solved many of the problems facing us in the matter of evaluation.

To use still other words from another person, "The development of evaluation procedures has, undoubtedly, been largely resolved when the objectives were originally specified. For it will be seen that very specific behavioral objectives are often the actual statement of the evaluation procedures. Objectives and evaluation should, in essence, be identical.(3)"

Mr. Dyer finishes his interesting paper when he says near the end that "in the last analysis, an educational goal is adequately defined only in terms of the agreed-upon

procedures and instruments by which its attainment is to be measured. It is to say that the development of educational goals is practically identical with the process by which we develop educational tests. It is to imply what in some quarters might be regarded as the ultimate in educational heresy: teaching should be pointed very specifically at the tests the students will take as measures of output; otherwise neither the students nor their teachers are ever likely to discover where they are going or whether they are getting anywhere at all."(4)

The challenge is to learn how to express objectives in terms of observable student behavior. In the words of Mager, "An objective is an intent communicated by a statement describing a proposed change in a learner – a statement of what the learner is to be like when he has successfully completed a learning experience."(5) Writing objectives is an exercise in communication. When an objective is described in keeping with this definition, the method or means of evaluation is usually obvious. To be able to run 100 yards in 14 seconds, or to be able to list the tragedies of Shakespeare, are simple examples of the kinds of statements we mean.

In most cases the writing of meaningful and proper educational objectives is much more difficult. I use the word "proper" because the use of behavioral terms does not guarantee that the objective will be the right objective or the best one. Actually, there is a danger, because those goals most amenable to behavioral descriptions are usually the most trivial ones. This is the danger Mr. Dyer was alluding to when he mentioned the "so-called 'behavioral terms' we so much admire."

Nevertheless, the challenge remains. If we are to move toward criterion-based evaluation, more and more teachers (I was going to say every teacher) must become adept at expressing their goals in meaningful behavioral terms. Incidentally, this also is a good device for clearing the fog around educational outcomes, because we have to prove what we are teaching rather than using a lot of word-magic to express what we would like to think we are teaching. Another way of stating this is to say that teachers are more likely to clarify in their minds what the outcomes of their teaching ought to be if they can first establish what the outcomes really are.

It is not the purpose of this paper to try to describe the steps to go through in preparing such objectives. It does seem appropriate to state that while most of us in this audience have written many objectives, very few of us are adept at it, in terms of the definition I have mentioned. If you are intereste in trying to improve, a good starting point is Robert Mager's book, Preparing Instructio al Objectives.(5) But this is only the starting point. You can get through the book in two hours at most, but then the hard work starts – trying to apply what he sets forth.

An interesting sidelight growing out of this new attention to criterion-based evaluation, educational goals and behavioral descriptions is the study of process as a part of content. One of my professors calls it a "sub-network of this new focus."

One of the reasons for this tack grows out of the concern or difficulty in trying to predict with much certainty what the world will be like in 20 or 25 years when the children now in elementary school begin to take over the social and economic controls. Several years ago Margaret Mead stated the problem in very few words. She said, "If we can't teach every student ... something we don't know in some form, we haven't a hope of educating the next generation, because what they are going to need is what we don't know."

She added: "What we now have to teach them is to get ready to learn things that nobody knows yet."(6)

The challenge here, it would seem, is that we ought to find better ways for helping young people learn how to learn new things. The easy way is to say that we will help them to learn the process of discovery. Here again we are confronted with the task of defining the outcomes we have in mind, but the challenge is intriguing.

One example of this approach is an experimental course called Science– A Process Approach (American Association for the Advancement of Science, 1964a, 1964b). It was founded on the concept that the purpose of teaching science in the elementary and intermediate grades is to train the child's skills, from an elementary level to more complex levels, in applying the same intellectual processes which are used by adult scientists in their work. Instead of learning discrete facts and knowledges about elementary geography, biology or chemistry, the emphasis is upon such processes as recognizing and using space/time relations, observing, classifying, measuring, communicating, inferring and predicting, with learning experiences from various sciences. In setting up the evaluation procedures, behavioral objectives are used as a starting point.

While this may be slightly off the subject, there are some interesting implications

for evaluation, primarily because of the necessity for a clear definition of what should be learned. If you are interested in a short reference on this topic, I would suggest Parker and Rubin's booklet on Process as Content.(7)

Let us turn now to the concept of individualized learning packages which are inherent parts of what some are calling "instructional management strategy". The terminology is new; the concept is old. There are various modifications and refinements and improvements, but the basic idea is the same.

More than 30 years ago Professor R. W. Selvidge published a book called Individual Instruction Sheets. I expect there are many in this audience who have used this book or were members of a class in which you were required to prepare job sheets, operation sheets, information sheets or guidance sheets. The philosophical and psychological bases from which you started may have been different, but the idea was the same: to individualize the instruction of the student in keeping with his needs and abilities.

At the University of Minnesota more than 20 years ago we were attempting to vary and modify the idea in the form of what we came to call "Activity Assignment Sheets". Here again, the idea was the same: to provide a learning guide to enable each student to proceed in his own direction and at his own pace. I expect there are quite a few in the audience who have had experience in preparing Activity Assignment Sheets. I mention Minnesota because of first-hand experience there, but I am sure many of you had similar expriences at sister institutions.

I would be the first to admit that some of those Activity Assignment Sheets were crude, but some of them were "good-looking", and some of them were as effective as some of the "new" packages being developed today in other subject matter areas. I am dwelling on these Activity Assignment Sheets, not to try to prove that they were good or bad, but to allow me to say that as we worked with the idea and sought improvements, one weakness that became apparent was in the area of guiding the student in his self-evaluation efforts. A study of this weakness led us to the realization that we were not doing a very good job of defining what we expected the student to learn.

I wish I could say that we licked the problem and found the solution, but that was not so. I wish I could start all over again because the ideas with which we were experimenting then still contain elements for a real educational breakthrough. Why don't some of you provide the philosophical, psychological and methodological know-how which will provide the refinements necessary for such a breakthrough?

What are the new writers talking about when they speak of individualized learning packages? Most of the assumptions are the same, but I will use the words appearing in the January, 1968, issue of Phi Delta Kappan to suggest some of the assumptions that are made.(8)

First, the pupil's responsibility is to learn and the teacher's responsibility is to make available to the pupil that which is to be learned. The teacher does not cover a course, but rather uncovers it.

Second, the subject matter of a course must be appropriate to the learner with reference to (1) pace of instruction, (2) level of difficulty, (3) relevance of the material as perceived by the student, (4) pupil's level of interest and (5) individual learning style of the pupil.

Third (and this is different), the size of a group, the composition of a group, and the time allotted to a group should be appropriate to the purposes of the group. (This is an incomplete description of a recent and new dimension – the interaction of large group instruction, small group instruction, laboratory instruction and independent study. One of my colleagues says that this idea isn't entirely new either, as he experienced something similar in "country school".)

A fourth assumption of the instructional management strategy is that before truly individualized instruction can become a reality, learning packages are needed which will provide for self-paced rather than group-paced instruction.

Here we are again with criterion-based evaluation. The learning package contains instructional objectives which tell the pupil what he will have to be able to do when he is evaluated, the important conditions under which he will have to perform, and the lower limit or quality of performance expected of him. Multi-dimensional learning materials of varying difficulty are cited and diversified learning activities are provided.

Provision is made in the package for pre-evaluation to assess the extent to which the pupil may already have achieved the objectives. Self-evaluation activities occur along the way and are used to indicate a readiness for the post-evaluation which is in terms of the original objectives set forth.

This is a hurried treatment of individualized instructional packaging, but you will be hearing much more about it. If the idea interests you, read the article by Philip B. Kapfer in the January, 1968, issue of Phi Delta Kappan, entitled, "An Instructional Management Strategy for Individualized Learning." He expands on some of the things I have had time only to mention.

Any discussion of individualized instruction and new concepts in evaluation soon leads to what I will call (for the purpose of this paper) evaluation hardware. Perhaps a better heading would be "Evaluation concepts in the burgeoning technology of education." Instant evaluation, quick grading or improved techniques of evaluation are invariably a part of the technology. Without attempting to be definitive, let us look briefly at some of the developments. (Again, I have appended various references for the person who is interested in more detailed descriptions.)

Computer-assisted instruction (CAI) has become a familiar term to describe the many attempts being made to individualize instruction with the help of a computer. This has become a glamour term and one must be wary of the "gimmicks". However, the potential is enormous if we have the creativity to use the tools properly. One source to which I have referred you is entitled "Computer Technology and the Future of Education".(9)

The technology is already available, although improvements are constantly being made. Two difficulties exist, however. Currently it is expensive to prepare an individualized program. The second difficulty, and even more important, is that as yet we have little operational experience in precisely how this programming should best be done. This is one of the reasons to be wary, but each of us should become better acquainted with the various attempts that are being made. Because of these various approaches we are beginning to collect some hard data which will provide an exciting basis for fruitful investigations.

To this point, three systems or uses can be identified. In each case, various kinds of hardware have been and are being developed. The first are usually called "Drill-and-Practice Systems". These are mainly a supplement to the regular curriculum taught by a teacher. Presently, this is by far the most useful application of technology in an applied school setting. In simplest terms, this system of teaching machines relieves the teacher of a considerable burden and at the same time provides practice work for each student at his own pace and level of complexity. One example is in the mastery of arithmetic skills. As the student practices over and over, he receives instant evaluation of his efforts.

A second area of computer use is called "Tutorial Systems". In contrast to the drill-and-practice system, the tutorial system takes over the main responsibility for developing ability in the use of a given concept. Skill subjects such as reading, mathematics and elementary foreign language are areas where a considerable amount of work has been done. The attempt is to approach the relationship a tutor would have with a student. While more difficult to program than drill-and-practice exercises, computer programs have been developed in a variety of subjects such as I have mentioned. Again, the manner in which the evaluation information is programmed is very important, because the answers are not always right or wrong – a selection is possible if the proper reason is given. This is in contrast to the drill-and-practice systems.

Still more complicated are the "Dialogue Systems". Here the intent is for the student to conduct a general dialogue with the computer. The student and the computer talk back and forth. For the most part dialogue systems now exist only as elementary prototypes because of some difficult technical problems that remain to be solved. One of the many problems is that of recognizing the spoken word. When the theoretical possibilities are realized, a child will be able to talk to the computer in the same way that he now uses a typewriter.

One writer describes the state of the art with this expression: "Within the next decade many children will use individualized drill-and-practice systems in elementary school; and by the time they reach high school, tutorial systems will be available on a broad basis. Their children may use dialogue systems throughout their school experience."(9)

With these three types of systems in mind, let me describe a rather sophisticated computer-based environment. I think the evaluation inferences will be obvious.

"The student station, or console, is connected to the computer by coaxial cable or by telephone lines over a distance. It consists of a television-type screen, a light-pen, a typewriter keyboard, and often earphones and microphone as well. Photographs, words, drawings, tables or equations are lighted up on the television tube; microfilmed pages or sections of pages can also be enlarged and displayed on a similar screen. When sound

is important, as in learning Russian pronunciation or analyzing musical phrases, information is received through earphones. Or, for question-and-answer drill, the student may sit before a teletype machine, which types out messages to which he replies by typing back.

"At his console, the student may respond to questions by asking questions of his own, or 'talking to' the computer, in two ways: (1) on the typewriter keyboard below the television tube, he may type his responses in ordinary English or whatever is appropriate to the subject being learned - for example Spanish phrases, numbers or letters of symbolic logic; (2) he may use the light-pen, a device resembling a pocket flashlight, to point to some part of the visual display - for instance, the correct answer in a multiple-choice question. When the light-pen is touched to the screen, the exact point of contact is automatically transferred to the computer's memory. In this way, also, incorrect material may be erased by tracing the light-pen over a section of the image. A revised display will appear on the tube."(10)

While this sounds like, and is, a sophisticated learning environment compared to what was possible a generation ago, the developments are so new, relatively, that "we ain't seen nothin' yet."

Computers are also being used in a variety of ways specifically to aid in the grading process. Various kinds of programs have been developed making use of an optical reader along with a computer. One such program at Colorado State University uses an IBM 1231 optical reader and an IBM 1401 computer. Answer sheets are fed into the optical reader and computer at the rate of 600 to 2000 an hour depending on the type of analysis and the format or type of print-out used to report results.

These particular programs were designed to provide: "(a) accurate and efficient scoring of tests, (b) item analysis to improve test construction, (c) individual reports to students and faculty, (d) references to areas to be improved, (e) maintenance of grade registers for large classes and computation of final grades using computers."(11) Many schools are experimenting with this kind of hardware.

An interesting area of research is in the use of the computer for grading essays. Think of what this will mean for the poor English teacher. I do not want to go into detail other than to say that it appears real progress is being made. But, as we might expect, skepticism also is being voiced. One writer claimed that human essay grading is good because it is subjective - that is, because one teacher will not agree with another. Another critical article contained a cartoon showing a weird machine with the caption entitled "Great Scott! It's just flunked Hemingway."(12)

While mentioning the grading of essays and papers, one teacher uses a much less sophisticated piece of hardware to aid him in the process. In an effort to save the time of writing his evaluation comments and to personalize the process, this instructor uses a tape recorder with a small individual tape for each student. This is a piece of equipment available to most teachers and the possibilities are present for various evaluation uses. This is suggested by the title of the article I came across, "Building Rapport through Recordings".(13)

Before leaving the topic of technology, passing mention should be made of the possibilities of videotape and instant-playback. The advent of micro-teaching has introduced a new concept of evaluation which holds many intriguing possibilities. With the rapid reduction in the price of TV cameras and videotape equipment, this tool will become available for various kinds of teaching-learning uses. My original outline called for a rather detailed treatment of micro-teaching and instant evaluation by sound and picture, but I noted in the convention program that this concept is the subject [illegible] meetings, so I have chosen only to mention it here (I have included a useful reference in the bibliography).

Getting away from technology and the "gimmickry" of evaluation, I would like to finish my remarks with a reconsideration of two old concepts that could stand a lot of new attention - peer evaluation and self-evaluation.

The fact of peer evaluation is not something new. It is going on all the time. In one sense, wherever you look everyone is evaluating everyone else. Consider your behavior right now. You are evaluating the words I am saying, the appearance I am presenting and the environment surrounding you. You are in the process of making some kind of a value judgment about this particular experience. Of course, some of you may have made that value judgment already, and tuned me out completely, in which case you're not hearing what I'm saying, anyway.

Could we do a better job of tapping in on the fact that human beings spend much time

observing, evaluating and drawing conclusions about other human beings? What is the potential of this fact as far as academic evaluation is concerned? What is the learning effect when students assist in evaluating the academic achievements of their fellow students?

Eleven years ago I made some similar observations in a paper entitled, "Industrial Arts Teacher Education in 1970." The remarks are still pertinent and I would like to repeat one of the paragraphs.

"Back to the movement for more independent study. As this gains momentum, we will be learning how to do a better job of utilizing peer evaluations. This will be a natural outgrowth of the demand for more and more self-direction on the part of the learners. As this trend gains stature, I can envision students serving as examining committees to evaluate the skills and knowledges, as well as the attitudes of their fellow students. They already do this as a natural part of working with groups, but the process is informal and unorganized. We should learn how to exploit this potential and make such evaluations an integral part of the teaching-learning process. This does not imply taking the final evaluation out of the hands of the instructor. Rather, it is a means for providing him with much more useful information to make the final evaluation."

These thoughts still hold, but not much has happened in 11 years. Peer evaluation has been used in sociometric and personality studies, but in my quick review of the literature, I did not run across any new investigations or even recent descriptions of peer evaluations being used as a part of the academic teaching-learning process. I am sure things are happening, but there ought to be a greater thrust, and more publicity given to this fruitful field for study and experimentation.

In bringing these remarks to a close, I would like to remind you that in the end every student becomes his own best teacher – this by way of re-emphasizing the importance of self-evaluation in the teaching-learning process. The upswing of criterion-based evaluation and the various developments in individualizing instruction will put more and more stress on self-evaluation, and this is good.

Earl C. Kelley, distinguished professor of education at Eastern Michigan University, stressed this same thought when he was writing about "New Approaches to Educational Outcomes." He said: "It is still true that how a person feels is more important than what he knows. How a person feels controls behavior. What he knows is important too, because this is what he used to behave with. But what he knows has to be relevant, meaningful to him. Otherwise it will for the most part be soon forgotten, and cannot function in behavior...."

In agreeing with Dr. Kelley, I would like to repeat a statement made 12 years ago at the 1956 Milwaukee Convention. I was talking then about the "thinking" teacher who would try to do something about the fact that our evaluating efforts are largely external in nature.

We, as teachers, place our stamp of approval or disapproval on what Johnny is or does. We give him a mark and then he goes on to the next grade and we forget about him. Ten years later that mark does not hold much of real significance. But Johnny's evaluation at the time he is taking the course may hold many seeds of significance for a decade later. The point is that what *he* thinks and the way *he* feels about things, we usually disregard. We blithely give him a mark and go on our way.

We spend most of our efforts in seeing what Johnny does to a board-foot problem without much concern for what the board-foot problem does to Johnny. We do a pretty good job of determining what Harry does to and with a piece of wood, but we still need a bit of help in trying to learn more about what the piece of wood does to Harry.

"What makes meaningful assessment of educational programs so difficult is that the value of an education really depends upon the life lived by the learner.... We have difficulty in measuring the many aspects of one's life.

"The good citizen who participates in the affairs of his community and of the world, who cares for his own, who cares for his neighbor must be considered to have had a good education. Whether he remembers what the Missouri Compromise was, for example, is not harmful, but irrelevant."(15)

Self-evaluation is the kind that really matters because it results in judgments that are built into experience. This becomes a functioning part of the organism.

Teachers, too, need to use self-evaluation, at least as much as their students. This is the way to improve teaching. This is the way to get rid of the humdrum routines so often found now.

We need to work on more self-evaluation instruments to aid in the process. We need

to explore and utilize properly the new concepts and tools, some of which have been discussed in this paper.

But in doing this we must never lose sight of the fact that each learner is unique. There is still so much we do not know. Regardless of progress, much of the assessment of outcomes will have to be done individually, subjectively and, above all, humanely.

Whatever the new concepts, whatever the new developments, whatever the new technologies, all of our evaluation efforts should be aimed at helping our young people become "more loving, less hostile; more courageous, less fearful; more free, less enslaved."

This is a big order, but we can stand for nothing less.

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Tu-3.2 ACIAS
ACIAS General Session
COMMITTEE REPORTS—MIDDLE SCHOOL GUIDANCE, RECRUITMENT, AND PUBLICATIONS
Chm., G. Wesley Ketcham; Rec., Frank Kanzaki; Speakers, Herbert Y. Bell, T. Gardner Boyd, Herbert Siegel, Robert Woodward; Host, Theodore Guth.

A REPORT ON MIDDLE SCHOOL CONCEPTS

Herbert Bell

The NASSP Bulletin for February, 1967, reports that the chairman of the 38th Annual Junior High School Conference, Dr. Jacobson, opened the spring meeting by predicting, "We may be attending not one, but two meetings today – the last Junior High School Conference and the first Middle School Conference."

Just what is a middle school, and what grades does it encompass? The answer is not firm nor fast and shows all kinds of variations. It covers, in most cases, grades six, seven and eight; but it can be five, six, seven, eight; seven, eight, nine; seven, eight; and just about any other form of these grade levels that you might wish to create. Let's just say it is the school between elementary and high school.

The real questions we need to ask ourselves are: What kind of educational program is best for young adolescents? What kind of teacher will best serve the needs of the child of this age level? What should the program be like? What kind of plant should it be housed in? What should be its organizational pattern for instruction?

A review of the available literature gives many partial answers, most not new, but nevertheless we must accept the concept and see how it does and can affect our programs. Before we proceed to these partial answers, it is best that we review the whys and background of this organization and see what has made it tick its way to the forefront.

The so-called new pattern seems to solve problems not educational but primarily social, economic or administrative. De facto segregation, slum school removal, Negro boycotts and deficient budgets certainly have played an important part in their creation. Others, we know, have entered the new door to get on the bandwagon, and others have entered by pure accident and housing needs. The NASSP Bulletin for February, 1967, says, "In some cities integration was clearly a factor, as new attendance districts were made to cross old neighborhood boundaries in order to bring a diverse population into the intermediate grades. The retirement of ancient school buildings and population shifts within cities have played a part in the establishment of middle schools."

We do not hear enough of, "Let's give this new unit a status of its own, rather than 'junior' classification."

We know that its concept has gained momentum, and some individuals even claim it may become the major educational development in our times. Just how fast is its growth is hard to judge, because research is virtually non-existent. This lack is particularly apparent regarding subject areas and what they can do for kids, to the point of being criminal neglect. The rate of growth, however, seems to be phenomenal.

Dr. Thomas Curtis of State University of Albany, NY, defined the middle school as "a transitional school concerned with the needs of early adolescents." (Note: This is the same definition used in the past to describe the junior high school.) He goes on to say that the new organization can provide better for the earlier developmental age of youngsters. No one can disagree with this, but research also shows each grade level is far advanced over the same grade level 25 years ago. Time magazine credits a Connecticut high school teacher as saying, "If Booth Tarkington were to write Seventeen today, he'd have to call it twelve."

As organization expands, programs (many along the lines of the present junior highs) develop. Many are not new and are built on poor foundations. According to Marshall Schmitt, the strength of the present junior high program lies at the ninth grade, and the removal of this unit leaves very little behind. (The junior high survey by Douglass and Gruhn verifies Marshall Schmitt's survey.) In order to fill this void, ideas of all types appear in writing. The Bedford school system's report is a good example. "Home economics and industrial arts were originally invented to convey middle class values and the rudiments of industrial skills to the waves of immigrants hitting the American shores –

this particular task is no longer relevant – and what future citizens of Westchester County need in this area is not lessons in 'cocoa cooking or hammering together bookends and footstools', but an understanding of the aesthetics of design for the home and some knowledge of how the television set and the power lawn mower work."

The conferees felt that home and industrial arts should not be segregated by sex. The girls should know something about auto mechanics and electronics, and the boys should have some feeling for a fine piece of furniture. All of these subjects should be closely integrated with the academic part of the program, especially with music, fine arts and science. There should be few if any distinctions drawn between the aesthetics of textile design and the aesthetics of painting and sculpture or between the desire to repair a switch and the desire to construct a ripple tank as part of the study of the physical universe.

These speculations gave rise to a further idea that the home and industrial arts programs should literally be put together with the art, music and theatre programs into a "unified arts program". These activities should all take place in a single, large, relatively open space – as several participants put it, "a big barn". This space should be equipped with all the devices, machines, instruments and materials that any of the arts might need.

The same reports show time use for unified arts at 15 percent; only independent study has more time. The professional personnel available to serve these students is also interesting. For every 1000 enrollment, 10 teachers are needed for English and unified arts, followed by math, science and social studies, eight each, and foreign languages and physical education, five each.

A summary of the number and type of spaces needed for the unified arts center shows: "(a) Offices for each subject area; (b) a shared conference and workroom; (c) a little theatre to seat 400; (d) stage and storage facilities off Little Theatre; (e) lobby to serve as exhibit gallery; (f) space equivalent to two industrial arts rooms; (g) space equivalent to two art rooms; (h) space equivalent to two home arts rooms; (i) music space, instrumental, choral and practice".

The same idea appears in the Michigan Association of School Boards' reports and should give rise to deep concerns. "The middle school concept with its unified arts program (arts and crafts, industrial arts and homemaking – rotating blocks of time) for the seventh and eighth grade students can provide a highly stimulating pre-high school experience in these areas. While it is not the purpose of this discussion to present the rationale and the program for unified arts in the middle school, such a program requires a much less elaborate facility and equipment. Its pre-high school function leaves something for the high school programs and the high school youth."

The educational specifications for a middle school at Naples, Florida, agree in part with the other reports that "the facilities, tools, work spaces, equipment and instruction should be based on pupil interests, interdisciplinary cooperation or articulation between departments, and instruction for the individual in preparing his projects. Thus, the tool skills laboratory becomes an extension of the academic, and the instructor becomes a resource person, consultant and a member of a teaching team."

Drawings of the middle school of tomorrow appear in the last chapter of Samuel Popper's, The American Middle School. These drawings show units of houses for core student subjects and the barn unit for creative assembly and exercise.

With no consensus as to grade levels or what ages should be bracketed, goals still must be assessed. According to an Educational Lab Report, "This period of education must take the child from his elementary concentration on basic skills to the use of those skills in the acquisition of knowledge and the development of human and social relationships." We might call James Conant the "man of the hour" in solving these problems: for educators, in an attempt to answer his criticisms of the junior high school, have pushed to the front this new middle school idea. Some of his concerns, "placing the seventh and eighth grades in a 'junior' secondary school, have led to the widely deplored tendency of some junior highs to ape the senior high in unhealthy ways. Extreme specialization of subject matter – a loss in guidance – highly formal and abstract instruction and undue emphasis on college preparation – interscholastic athletics, marching bands and formal dances – too much too soon. The place of grades in the organization of a school system is of less importance than the program provided."

Just what then shall be the organization? In the October, 1965, issue of Saturday Review, Paul Woodring refers to the new intermediate school as, "not bound by college entrance requirements, offers abundant opportunities for experimentation, new staffing

patterns, including the many varieties of team teaching, dual progress plans, and programmed learning, flexibility to the hilt and organizing teams of all sizes are only part of the master plan. Instructional groups of various sizes, modular schedules, non-gradedness, seminars, independent study, teaching machines, audio and film cartridges with play-back devices, para-professional, one-to-one relationships, as well as performance and non-performance level groups are only a few of the ideas being discussed. The main thought is to provide a flexibility maximum in order to meet the varying abilities, rates and interests of youngsters. A great emphasis is placed on individual study skills and individual responsibilities."

In a June, 1965, Educational Facilities Laboratories Report, Judith Murphy says, "There is a cause to be made for keeping it fluid and not endowing this new kind of school with a full-fledged rationale."

On the other hand, by actual practice we find that schools having enrollments of fifth and sixth graders usually assign them to one classroom for a large share of the time, under one teacher, using specialization with "subjects like art, music and shop." (Educational Facilities Laboratories Report). This fifth-sixth grade core leads to some departmentalizing and specialization for seventh-eighth graders. The Michigan Association of School Boards reports in The Middle School,

> At the sixth grade level, while a class may have the same teacher for most of his subject areas, increasingly learning activities will be directed by other sixth-grade level teachers, specialists and consultants; at the fifth and sixth grade levels all boys and girls will be concerned with fine arts, arts and crafts; at the seventh and eighth grade levels, students will then go to special teachers for unified arts (arts and crafts, homemaking, industrial arts).

The idea of the barn does not seem to be developed in actuality. A review of ten plans shown in The Middle School Report by Judith Murphy for Educational Facilities Laboratories shows four plans with unit shops; three with unit shops adjacent to home economics and art; one unified center, and two general shops. Most educational specifications state that spaces should be rearranged quickly and easily, yet none of these plans take this into account. The idea that the plant be designed to be used by both children and adults seems to have been considered.

Very little reference has been made to equipment in most of the reports, thus making the one in Clearing House, February, 1966, very important. "It eliminates the need for special programs and facilities for one grade and eliminates the problems created by the fact that the ninth grade is functionally a part of the senior high school. It reduces duplication of expensive equipment and facilities for the one grade. The funds can be spent on facilities beneficial to all grades."

One of the big questions that remains to be answered is that of staff. Samuel Popper in The American Middle School says, "The junior high school has been aptly described as the 'school without teacher', because its teachers have been prepared for careers either in senior high schools or in elementary schools. It appears to be a matter of prestige. There are few institutions in this country which specifically train teachers for junior high school." Most of us are aware that personnel officers for school districts care little what a person is trained for in his major field but hire on strengths of individuals. The success of the school program may well hinge on the ability of colleges to train teachers and on the ability of this new idea to attract them. A good look at colleges for reorganization of teacher education might well be high on the priority list. Pearl Brod in Clearing House, February, 1966, sums it up, "Since existing patterns of neither the elementary nor the secondary teacher training programs would suffice, a new pattern must be developed." We know that part of this new pattern, regardless of teaching field, must be the mastery of core curriculum teaching.

We as industrial arts leaders perhaps have a greater need to cope with these questions than most subject areas. Where have we failed, or have we? We must have, for if we have not, why then are so many rearrangements being made in our subject area? Just what should we teach and how? Will the range of activities be like New York's early secondary guide, Introduction to Materials and Forces? This guide relies heavily on hand tool skills for all areas of instruction and does little with concepts, so it won't be accepted by all of you. In the article, "The School in the Middle," The Journal of Industrial Arts Education, November-December, 1967, Sam Porter says, "Indeed there is evidence that 'exploration' in the junior high school is limited to experiences in courses and labs identical to those of the high school, except that the work is often confined to smaller sizes, hand tools and perhaps lower standards." Take a good look at most eighth grade programs,

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and you will find them relying heavily on hand tools for instruction. This may be how we are viewed and why others dare set programs for us.

In reality, Dr. Porter has done much the same work this committee is doing, and his findings and questions are basically the same. To quote Dr. Porter:

> Two steps must be taken when industrial arts faces a move to the middle school. First, a set of working principles must be compiled. Secondly, the realities of the local situation must be adjudicated with the working principles.

Dr. Porter goes on [illegible] ralize the actual practice that should be the basis of the working principles: (1) [illegible] y of industry and its impact upon the lives of individuals should be an important part of the work in each grade of the middle school; (2) the organization of the middle school should explcit the use of the specialized industrial arts staff and facility in de[illegible]oping [illegible]rriculum that is characterized by unity and articulation; (3) like all other [illegible]bjects [illegible]ne middle school, industrial arts should adapt itself to the transition from the se[illegible] [illegible]tained classroom in the early grades to the mo[illegible] segregated offerings in [illegible] [illegible]er grades; (4) industrial arts in the middle school must be characterized by explo[illegible] experiences in a wide variety of media; (5) the middle school and all of the discip[illegible] within it should feature emphasis upon individualized instruction; (6) the middle school, and industrial arts within it, should place primary emphasis on factors that lead to the continued quest for knowledge; (7) a continuing in-service program should assist teachers in understanding the middle school student and the methods which are most appropriate to the unique characteristics of this age.

In an editorial for Educational Leadership (ASCD Journal), 1965, Gordon Vars says, "Yes, junior high schools are changing. Yet the basic question remains the same. 'What shall be the nature of education for young adolescents in today's society?' Neither changing the institution's name nor moving its grade level brackets up or down a notch will necessarily affect the character of the education it provides. Instead, educators at all levels must seize the opportunity represented by the present state of flux to try once again to make of the intermediate unit a truly unique institution for the age group it embraces."

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GUIDANCE IN INDUSTRIAL ARTS

T. Gardner Boyd

Foreword

The world of work today is changing so rapidly that personal adaptation and development require a greater degree of self awareness. Industrial arts can play a very important part in providing pupils with information and problem-solving experiences which can assist in obtaining constructive utilization of our most vital resource – manpower.

In former times, when occupational and professional life was less highly specialized, parents assumed a responsibility for informing their children about careers. Most parents today, however, find themselves severely limited in knowledge of the breadth and variety of opportunities possible for their children. This has led to a growing demand for the school to assume a greater responsibility in assisting young people in their career development.

Industrial arts educators have become dramatically aware of the role their curriculum offerings should play in assessing their obligations in an era when full utilization of all talents is essential to the nation's future well-being.

The purpose of this publication is to provide the industrial arts educator with a guide that points out the guidance function of industrial arts, and to present some ideas and methods which might assist the teacher in performing this phase of instruction. The task is not a simple one and the best methods for facilitating instruction in this area have yet to be worked out. There is rich opportunity here for creative imagination and experimentation in guidance.

The School Guidance Program

An effective school guidance program is dependent to a considerable extent on the active participation of the administrators, counselors and classroom teachers. Each should share a part in the performance of a total program. A team spirit should be developed with everyone carrying out the phase of guidance which his specialty presents.

Guidance has in the past been conducted for the most part outside the classroom through the limited contact of a counselor with pupils. However, a trend has been developing to put guidance into the classroom and to develop an integral relationship between the counselor and all teachers, with the administrator giving leadership and support to this approach. All teachers must assist the counselor if we are to provide each pupil with occupation and career information which will assist him in making a wise choice for his future vocation.

Who can really say what kind of world tomorrow will bring? One of the striking features of contemporary life is the explosive rate of technological change and the increasing complexity of our social organization. With technological developments continually creating new jobs and rendering old ones obsolete, it becomes virtually impossible to predict the specific job a student in school today may be called upon to perform during his working adult life. This mushrooming multiplicity of pursuits from which one may choose is further complicated by the low visibility of many occupations. The nature and function of an occupation is not readily apparent to one not engaged in it. For example, many students selecting engineering for a career really do not understand in advance the functions actually performed by this worker, let alone the social problems and psychological factors that delineate the specifications of this occupation. Young people frequently have only a hazy notion of what a design draftsman, tool and gauge maker, printer, pattern maker or electronics technician does during his working day.

The educational challenge is clear. We cannot and should not make occupational choices for an individual student, but it is certainly our responsibility to provide experiences which help him develop his potentialities, plan wisely in light of all the knowledge that can be mustered about himself and about the world in which he will live and work. The school must present a well-defined program of guidance with built-in procedures for continuous and systematic appraisal of pupil abilities, interests and values. Varied and realistic information which will help orient students to the world of work and educational opportunities will need to be a planned part of the program as well as systematic counseling of each individual pupil to assist him to use this acquired knowledge in understanding himself and in testing the reality of his plans.

Communications Between Administrators, Industrial Arts Teachers, Counselors and Classroom Teachers

The need for close working relationships between industrial arts teachers, administrators, counselors and teachers of other subjects can not be overemphasized if a successful guidance program is to be performed. To provide this teamwork, a planned program which involves these people should be worked out.

The following examples present some ideas that may be employed: (I) Meetings - to become acquainted, to discuss guidance problems, to plan guidance programs, to outline responsibilities, to correlate guidance information with other subjects; (II) Programs (carried out jointly between counselor, industrial arts teachers and others), including career fairs, field trips, TV careers programs, career assemblies and film presentations.

Evaluating Occupational Materials

An industrial arts teacher may ask, "How is it possible for me to know about every occupation to which my subject might lead?" The answer, of course, is that it isn't possible for him to know everything about occupations, but he can develop a system through which he can readily find the pertinent information needed for his subject's role in the school's guidance program. Micro-filming guidance information seems to be very promising in helping to solve the problem of providing a quick and easy method of having the desired information on hand when needed. Video tape also seems to hold a bright future for use in the field.

The problem of selecting suitable materials is a challenging one. Films become dated and many of them do not depict exactly what should be shown. At the present time, the number and choice of audio-visual materials which deal with careers are not too plentiful. There are hundreds of available pamphlets and books from which to choose, but they must be chosen wisely. Many of these publications have limited usefulness due to biased viewpoints, inaccuracies and other weaknesses. Because of the great need for developing criteria to be used in the preparation of good information, the National Vocational Guidance Association prepared a publication titled "Guidelines for Preparing and Evaluating Occupational Materials". However, there will always be some publishers who will ignore this association's standards because of their motive to promote the attractiveness of an occupation. For this reason informational materials will need to be carefully selected.

The following basic guidelines should be followed in selecting guidance materials: (1) An occupational publication should include a clear statement as to its purpose and the group to whom it is directed; (2) Occupational information should be related to developmental levels which will vary with age, educational attainment, social and economic backgrounds; (3) Dates of original and revised publications and of the data included should be given; (4) Implications of the material for all groups in our society should be considered; (5) The description of an occupation should be an accurate and balanced appraisal of opportunities and working conditions which should not be influenced by selfish interests; (6) The information should include the nature of personal satisfactions provided, the demands made and the possible effects on an individual way of life.

Orienting Students to Occupational Opportunities and their Place in Our Modern Industrial-Technological Society

The methods by which occupational information can be introduced are limited only by the ingenuity of the teacher. Opportunities for occupational guidance exist at all levels of a student's educational pursuits. A wide variety of specifically planned information should be provided so a continuous investigation of occupations can be conducted in each grade. Material presented should be consistent with the interests, maturity and experience of students at any given year. Information at the beginning grade levels should be general and proceed to more specific presentations at the more advanced years of education.

Elementary

Children at this level bring with them a natural curiosity about all things in their environment. They are interested in work, and their questions about different jobs should be answered. Young children may not comprehend all the effects work may have on their own lives, but there are many aspects of career information they can understand. They can begin to understand the effect work may have on a person's place of residence, clothes

h wears, hours he works; as they grow older the importance of work begins to take on meaning.

Industrial arts at the elementary level is particularly well suited to play a most important part in providing occupational information for young children. Many opportunities for relating the study of the occupational world are provided as students work with the tools and materials used in the industrial arts program. The construction activities can be correlated with the many units pertaining to the work world studied in other subjects. The motivation precipitated by the industrial arts program can promote field trips, further study and discussion about occupations. Live experiences are provided during the construction activities which assist these children in acquiring basic talents of industry such as cultivating work habits, organizing time and energy, cooperating with others and completing their work.

The enrichment of social studies units concerned with career information is a natural for industrial arts education. Usually the program divides naturally into two classifications — the early elementary (kindergarten through third grade), in which the child is concerned with work in the familiar surroundings of home and community – the later elementary (fourth grade through sixth grade), in which the child's concept of work expands to include his state, nation and neighboring nations.

The foundation for healthy career adjustment is laid during the elementary school years. It is important that topics introduced will stimulate sound concepts common to all work since attitudes formed at this level may be held permanently. A variety of exposures to occupational information is essential to arouse the child's awareness of the world about him, and experiences should provide maximum opportunity for vocational inquiry.

Junior High

This is an age when a student frequently shows an increasingly mature curiosity about himself and his environment. The junior high student strives to attain independence while simultaneously maintaining a basis for security. He begins to recognize that the independence he seeks must be justified by the acquisition of skills and knowledge. He demonstrates this in a desire for a better understanding of his own skills, interests and knowledge.

The exploratory nature of the industrial arts curriculum in the junior high program provides an ideal setting for the teaching of occupational information. Experiences with materials and broad exposure to fundamentals of industry and technology give youth an opportunity to plan, experiment and work in many major fields. Opportunities to study the underlying functions of industry and to explore their inter-relations are a part of the program. Through these practical experiences the student can more wisely assess and understand his interests, abilities, limitations and potentialities in our industrial-technical society. From this type of general education program, guidance for all students can be provided on both educational and prospective occupational levels.

Materials presented in junior high should be of a nature that will assist students in making decisions about high school courses and general education plans. Students should become acquainted with factors to be considered in choosing careers and planning further education. Here, as at all levels, students need information which will help them organize occupations in relation to their growing knowledge of themselves.

High School

Students in this level are, by experience and maturity, more ready to make tentative occupational choices for job entry or continuing education. Industrial arts education makes a unique contribution to the total educational program of the school as it interprets the functions, technology and occupational opportunities of our modern industrial society. At this level the program should include more specific information and job descriptions. An understanding and awareness of local and national job opportunities and requirements, the apprenticeship programs available, trade and technical school offerings and qualifications for entering post-high technical and professional programs should be a part of the industrial arts guidance information at this level.

Individual counseling by the school guidance counselor will begin to take on more meaningful and realistic aspects at this stage. Therefore, the industrial arts teacher and the school guidance counselor should give careful and thoughtful consideration to the development of a well planned and organized approach that will assist in carrying out a well-coordinated guidance program.

Studying an Occupation or Profession

With the thousands of different jobs in the United States to choose from, it is obvious that a thorough study of every job cannot be made. Even to study those related to the areas of industrial arts education presents a very formidable task. However, it is quite important that a student become familiar with a wide variety of career fields.

Various systems have been developed fo. classif ing occupations into groups. An example of this is the classification of the professiona.., semi-professional, managerial occupations, skilled occupations, semiskilled occupations, etc. Another job-classification system classifies jobs according to industries. Still another method uses a "job families" approach. .n this system occupations can be arranged according to families on the basis of certain similarities.

The following outline presents a guide which may be used in developing many of the specifics to be covered in studying an occupation or profession:

(I) Nature of the work - (a) activities, duties and responsibilities of the worker; (b) the kinds of interests involved in the occupation or profession; (c) restrictions affecting eligibility, such as, (1) age of those actively employed, (2) proportion of men and women, (3) physical requirements and (4) personal appearance.

(II) Future - (a) trends - stabilized, declining or expanding; and (b) location of demands - geographical.

(III) Personal requirements - (a) sociable, (b) energetic, (c) leadership qualities and (d) creative ability.

(IV) Qualifications - (a) kind of education, such as, (1) professional, (2) technical or (3) general; (b) level of education, such as, (1) high school, (2) technical school or (3) college (what degree); (c) certification, licensing, apprenticeship or internship; (d) length of training; and (e) cost of training.

(V) Working conditions - (a) physical, s[illegible] s of work, (2) where work is done, (3) seasonal, (4) sitting, standing, [illegible] (5) surroundings and (6) hazards; and (b) social relations, such as [illegible] ion, (2) working in groups or alone and (3) supervising responsibilities

(VI) Economic returns - (a) beginning [illegible] d rate of increases, (b) possibilities for promotion, (c) degree of security, (d) vacations, sick leave, retirement.

(VII) Related fields that may be entered - (a) with additional training or preparation, (b) without additional training or preparation, (c) ease with which change can be made

As a result of studying professions and occupations in industrial arts education, a desirable outcome would be that the student would develop an understanding of the need for investigation and a technique to follow when he becomes concerned with making a decision about his future.

Important things to remember are that the student must choose his own future career - adults can suggest but the choice must be his. Wise selection, based on careful and patient investigation, will increase the possibility of job satisfaction and future appiness. If the career chosen requires college or technical training it is wise to develop and maintain good study habits. Careers should be planned on the basis of professional or occupational information, not on the glamour of the field. A person can be successful in more than one career. An appraisal of one's intellectual, physical, educational and financial resources are a necessary initial step in professional or occupational planning.

Techniques and Procedures for
Providing Occu[illegible]al Information

There are [illegible] methods which may be used in presenting occupational information within the industrial arts education program. An imaginative teacher will make use of a variety of techniques designed for the particular age group involved.

Following are some ideas which might be implemented to assist in presenting career information:

--Industrial tours to give students an opportunity to see, hear, feel and smell the environment. Machines and jobs performed can be compared with those encountered in the industrial arts lab.

--Class discussion and lectures related to the various occupations may be conducted by (a) the industrial arts teacher, involving careers pertaining to the subject content of the course; (b) the guidance counselor, to acquaint students with the various sources of occupational information, and the related school courses which might be taken; (c) resource people from the community to present specific information and the relationships of various occupations in the community.

--Student reports and group discussions. Report assignments to carry out an investigation of occupations by students individually or in committees. A follow-up with group discussions after the reports have been given to help clarify and develop understanding about the various aspects of the types of jobs being studied.
--Job surveys of the community to help students become aware of vocational opportunities in their own locality. Students would learn to classify and organize job characteristics through this experience.
-- Audio-visual presentations. Video tape equipment, tape recorders, film projectors and charts can be used most effectively to arouse student interest.
--Resource centers for independent study. Books, pamphlets, films, tapes and periodicals should be catalogued so students can easily locate information concerning the career they wish to study.
--Occupational notebook to assist students in compiling individual profiles. Material included in the notebook should be personally related to the student preparing it. This will help him select and concentrate on careers which interest him. He will become aware of his strengths, interests and abilities as they relate to realistic and potential occupational goals.
--Records which may be used in cooperation with the guidance counselor. The industrial arts teacher could keep an account of a student's work habits, aptitudes, work experiences and other attributes which may have vocational significance.
--Visits to vocational-technical classes to acquaint students with these offerings which could assist them greatly in planning their future occupational programs.

Mr. Boyd is Director of Industrial Arts, Kansas City, Missouri.

RECRUITMENT OF INDUSTRIAL ARTS TEACHERS

Herbert Siegel

Teacher recruitment is a recurrent problem with which we all are familiar. In New York City we have tried many ways to attract teachers of industrial arts to teach in our educational system. We are also devoting a considerable amount of effort to the encouragement of high school students to consider industrial arts teaching as a career. Some of our plans have proved successful, while others have not.

In discussing my assignment at the American Industrial Arts Association Convention with the supervisors in my office, it was decided that we should have something more permanent in nature than a twenty-minute speech. So we borrowed a thought from the ancient proverb and are presenting a picture of what we have done over the past eight years.

The question has often been asked as to what the difference is between "public relations" and "teacher recruitment". It seems to me that they are one and the same, because anything we do is to improve the image of industrial arts. As a result of this effort we have teachers today who first attended our Future Teachers of Industrial Arts meeting as high school students.

On the following pages* you will see that our efforts in promoting industrial arts education have taken many avenues. We have concentrated on the students and parents, the guidance counselors, the teachers of industrial arts and the various sources in the community, such as the radio, TV, industry and various fraternal organizations.

Each of us is working in a different situation, but if we all present industrial arts education in its true perspective, we cannot help interesting those who are in search of a satisfying career. If each of us looks upon teacher recruitment as a personal challenge, we will help solve this problem.

I look forward to the future in the hopes that industrial arts teachers and administrators throughout the nation will send me their innovative ideas on practical recruitment practices. It is my hope that next year we will combine all of these ideas along with the ones that I have published into a national yearbook on recruitment.

*A bound presentation prepared by the Industrial Arts Department of the New York City Board of Education was distributed at this meeting, and may be available upon request.

Mr. Siegel is Director of Industrial Arts for the Board of Education, Brooklyn, New York.

REVISION OF ACIAS PUBLICATIONS

Robert L. Woodward

The publication Industrial Arts Education: Purposes, Program, Facilities, Instruction, prepared over a three-year period by the members of the American Council of Industrial Arts Supervisors and published as a professional service by McKnight & McKnight Publishing Company in 1963, has been a "best seller" of the American Industrial Arts Association.

At the request of the Council and the Association, this publication has been revised. The ACIAS Publication Committee, appointed by Council President Leonard W. Glismann, who approved/prepared the revision material, is composed of T. Gardner Boyd, Arthur J. Dudley, G. Wesley Ketcham, Kenneth L. Schank and myself, as chairman.

In revising the publication, it was kept in mind that much excellent thought went into the preparation of the original manuscript, that three years had been required to prepare the material, and that the final product was a compromise among regional philosophies. Essentially, the revisions relate to terminology, the inclusion of course descriptions for power mechanics, and the addition of a new section titled "Supervision of Industrial Arts Education." Terminology used in the revised material was based upon the US Office of Education's publication Standard Terminology for Instruction in Local and State School Systems, as well as upon the terms that have been accepted by the industrial arts profession since the preparation of the material for the original publication – which dates back eight years. Information obtained in the 1967 study to determine the updated "Duties of Industrial Arts Supervisors" was used to develop the new section on supervision.

The revised publication title will be "Industrial Arts Education: Purposes, Program, Facilities, Instruction and Supervision." The new publication will carry a 1969 publication date. However, advance copies will be distributed free to all active members of ACIAS during the fall of this year (1968). All current, active members of ACIAS will be listed on the final pages of the publication and those members who contributed to the original manuscript and/or participated in the 1967 study concerning "Duties of Industrial Arts Supervisors" will be so designated.

Earlier, it was mentioned "that much excellent thought went into the preparation of the original manuscript" – this point should again be emphasized. Often, supervisors are criticized as being too concerned with immediacy – that they do not innovate or have long-range goals. If you will take time to reread the original ACIAS publication, you will find that most of the basic ideas espoused by the new curriculum proposals are covered. We believe that you will be proud of this highly useful, revised publication.

Dr. Woodward is Industrial Education Consultant for the California State Department of Education, Sacramento.

Tu-3.1 ACIATE
ACIATE General Session
NEW CONCEPTS IN INDUSTRIAL ARTS TEACHER EDUCATION
Chm., Rutherford Lockette; Rec., Paul R. Miller; Speakers, Louis J. Kishkunas, Howard F. Nelson; Host, J. B. Morgan.

DARE OUR SCHOOLS— THIRTY YEARS LATER

Louis J. Kishkunas

Educators too often look upon demands for change as a threat or implied criticism of what has gone on in the past. This is especially unfortunate in these times in that the one phenomenon that we can depend upon is change. What was true and good enough yesterday is not true and good enough for today; what we know today will not be true tomorrow.

It used to be that we had two educative forces working for our society. The formal school structure took a very narrow view of what was required of it. Its early emphasis was on acquiring the basic tools for getting along in society – reading, writing, ciphering – and later on preparing its students for further educational experiences, either formal or informal. The second force, the informal educational institutions, would pick up at whatever point the student chose to spin out of the formal education system. It used to be that the farms, the mills and the railroads of our society could absorb the rejects of the schools and those who chose to leave the schools before completion of the course work. The absorbing function of these agencies is fast disappearing from our society, leaving the formal educational systems with the total job. Society can no longer depend upon industry to accept people unprepared to assume their role in the world of work.

The most challenging and dramatic condition of change comes as a result of the rush of our population to the urban centers. In 1900 only five percent of our population lived in the cities; by 1930 this had grown to 25 percent. Today, approximately 60 percent are living in our urban centers, and it is estimated that by the year 2000, ninety percent of our population will be living in the urban centers.

But more than that, other problems are being created by this phenomenon. The older, more established, residents of the cities are moving to the shell or rim of the cities, the newer sections, leaving the older core to the new migrants from rural areas. Moreover, a large portion of the new migrants belongs to minority groups who have been forced out of the society they know and have moved into a society which at first rejected them and now is trying in desperation to devise methods and crash programs whereby these people can accept their rightful place in society.

Images and former patterns are changing, but they must change faster. Over 80 percent of the residents of Manhattan are Negroes and almost half are non-English-speaking Latin Americans. This problem is not confined to New York. Los Angeles has, in addition to its large influx of Negroes from the rural South, hordes of Latin American non-English-speaking people moving into its core city. By and large these people come completely unprepared for the life that faces them. Unskilled and unlettered, the only work that they can find, if any, is the most menial. Too often, however, the only resource available to them in the way of providing subsistence is the relief roll, and this has become a way of life for large segments of our society. There are countless examples of families in the third and fourth generation of unemployment living on relief. This must change and the change is demanded by both sides. Those who provide the taxes and monies to subsidize large segments of our society are beginning to groan under the weight. On the other hand, those who receive the dole are becoming increasingly uncomfortable in this role. In 1965 we experienced the trauma of our first major riot in the Watts Section of Los Angeles. Since that time there have been countless numbers of upheavals which have only added to the trauma. The educational establishment is being forced to assume responsibilities which had never before been a function of schools, to correct the situation.

Social justice, the education of the deeply deprived, the fitting of a generation for a new world of salable skills or productive higher education, the inculcation of attitudes and values in the young, the struggle to humanize the deeply-scarred child of poverty, the

articulation of racially different children in a wholesome and mutually respectful relationship, the fulfillment of every young person as a unique and priceless human being through teaching and learning – these are the abstractions that society demands of education today.

There was a time when education could be defined solely as the arrangement for learning of certain skills, competencies and understandings. If this was ever true, it is no longer. There was a time, no longer than 30 years ago, when educators like George Counts might ask, "Dare the schools contemplate the creation of a new social order?" The question has been answered without the educators ever having weighed it. We in the schools are mandated to create a new social order, an order that includes assuring universal equality of opportunity, not because we are competent for the task, nor because we have sought the task, but because we are <u>here</u> – here in the schools – and because a new social order is happening: happening sometimes in spite of us so that its processes have been stuffed into the contemporary definition of education.

We are now undergoing a revolution for the poor. It is still an arrangement of the power of government to assist the poor through education and other institutions. The poor are not yet the initiators nor the agenda makers of the revolution, so it is still a revolutionary effort being made for them.

But the powers of the poor are being felt more and more, especially in [illegible] big cities, as the legal and ethical right to participate in their own destiny becomes [illegible] apparent and systematic. One may disagree with this arrangement; one may question the competence and sophistication of the poor to exercise power: one may observe the painful, dangerous and violent forms which this emerging power takes – but – the revolution for the poor is with us.

Many may perceive the revolution as a racial matter. I do not feel that educators can make this mistake. The facts are, more than two out of three of our poor people are white.

But we cannot forget that there are a great many Negroes packed into the decaying sections of our big cities, and they are a part of the changing arrangements of power. Equality of educational opportunity, never remotely achieved in America, must apply to both races.

More than 14 million children under 17 years of age in this country are living under the current definition of "deprived". The schools of America, principally through Federal legislation, are commanded by the poor themselves to produce a solution to this misery now. Federal law gives muscle to the poor. The demands from the people take many forms, most of them strident, angry and threatening. They are not concerned with due process, with consideration, or with the realities of budget and resources. Action <u>now</u> is the demand, whether for smaller classes, integrated schools, non-integrated schools, "better teachers", the removal of teachers and principals who appear to be symbols of education's past failures.

The conventional power of a big city still rests in its governmental structure, its industrial and cultural institutions, its organized labor, its selfless civic leaders who serve on boards of education, hospital boards, etc. But that power is no longer taken for granted by the poor, discomforting as that thought may be. The poor, and those close enough to the poor to enjoy their confidence and speak for them, are not requesting a hearing. They are demanding a piece of the Power. No matter how well-intentioned the old way has been or even how successful "doing things for people" has been – we have to find ways to do things with people. Arrangements must be invented for this unsettling phenomenon.

The bridge between the teeming social and economic problems of the big cities and the ultimate resolution of these problems must rest on a new order of education. If there is to be tranquility, social justice, economic health and a wholesome life in the big cities of America, the schools must be provided with greatly increased resources and they must be given freedom from harassment and tension in order to get on with the task.

We are not speaking blithely of solutions tomorrow or next year. We are speaking of a generation. We are speaking of the child now three years old, living in the third or fourth generation of deep crippling misery, who must through the schools and other agencies be made whole, given the environment, the concern, the valid aspirations that a free society owes him. The schools, greatly reinforced with devoted and respected teachers and wholly new and relevant curricula for the deprived, can, over the years, carry this child to fulfillment. The years from age 3 to 18 will provide, at the very least, a command of the fundamental academic skills for competent citizenship, together with an immediate relevant salable skill at whatever level of intellect. At the most, this child shall enter a distinguished institution of higher education for further fulfillment on full scholarship.

But if the bridge is to be a stable and dependable structure in this revolution of the poor, it must be safeguarded from the torrents of irresponsible force which would erode its very foundations. The teacher in the classroom is the essence of education. If we cannot attract to the cities a fair share of the ablest and best young people settling upon a career, we cannot respond to the new expectations society has put upon us. So long as inner city schools are places of hostility, public demands for ousters, parental disdain for the authority of the school, then the likelihood of success diminishes.

Many devoted teachers are working in the cities. But we need more. And we need ways to make the teacher, ever in short supply, more effective, more productive and more satisfied with this crucial role in this revolution. And if, indeed, education in urban America has been given the job of bridging the crisis of the cities, we must be given the time to carry out the task.

But to speak solely of class size or pupil-teacher ratio is to speak of "more of the same". In the first place, there are not enough teachers to make significant large scale reductions in class size. We must find ways to rise above "more of the same" and find creative solutions for greater productivity by professional teachers and a correspondingly greater sense of fulfillment and job satisfaction by urban teachers. New technologies, including information retrieval, computer-assisted instruction, independent learning, small- and large-group team teaching, closed circuit television, together with judicious use of para-professional personnel and volunteers, are resources which we must consider. If we are able to elevate teachers to roles of wider influence and effectiveness through these organizational inventions, the corresponding gains should flow to increased salaries. These inventions and their uses, furthermore, must derive from teachers themselves as elements of professional progress, if the measures are to be effective.

Educators are prone to segment the total picture of education. We speak of general education, vocational education, terminal education, academic education and so on. In skill-centered education, we talk of industrial arts, home economics, business education, distributive education, trade and industrial education and agricultural education. Each claims that it has a body of knowledge to impart. Some of these bodies of knowledge overlap. Too often we find ourselves in competition for funds, space and prestige. Shops and laboratories are not new to our schools. They have been with us in some form since colonial days. Skill-centered education, that is, preparing people for specific occupations, was a growing phenomenon until World War I when a traumatic experience hit our public schools. In 1917, the Smith-Hughes Act was passed to set up a sub-system of education within the general structure of public education. The act provided for generous subsidies to be provided to classes which met certain specifications and were taught by teachers with rather definite credentials. Neither the specifications for the classes nor the certification requirements for the teachers fit the general pattern in effect for schools. It was expected that the classes that existed prior to 1917 would wither and die, but they did not. Instead, the objectives were rewritten in terms of general education, and the classes and programs continued. In effect, we had vocational education occurring on two fronts – in the sub-system subsidized by the Smith-Hughes legislation and under the guise of general education in the "mainstream" of education.

Although the terms used to justify industrial arts education were stated in terms of general education, in too many cases skill was the most important objective. This is borne out in the recent study conducted by the US Office of Education on the status of industrial arts education, where the overwhelming majority of principals and school administrators polled justified the existence of industrial arts in their program of studies in terms of skill as its main objective, and even a majority of the teachers responded to the questionnaire in a like manner.

The Vocational Education Act of 1963 removed the onerous restrictions set up by the Smith-Hughes Act, thereby enabling vocational education to take its rightful place in the "mainstream" of public education. By tradition, vocational education had become so firmly entrenched and the hierarchy (which had grown up with vocational education) so wrote the plans that little effect was noticed in changing the direction of vocational education in the United States. Legislation is now before Congress which will further liberalize the administration of vocational education – which will even force state departments of education and local boards of education to take a new view of vocational education and include it as part of the "mainstream". It is time to merge these two forces, that is, industrial arts and vocational education, into one and to provide a continuum.

There are three unique functions which can best be performed by industrial arts as we know it in our school system. There is the guidance function – that is, providing

students with a knowledge of the working world so that he can learn more about himself, his likes, his dislikes, what he is good at, what he is not so good at and the requirements of industry, so that he can more intelligently make vocational decisions when the time comes. An essential ingredient which is lacking today must be built into the program. There are ever-increasing numbers of occupations which are not now considered within the sphere of industrial arts. I refer to those skills and occupations normally thought to be under the jurisdiction of home economics and business education. We must be assured that all students will be exposed to all areas covering those occupations usually included in these three disciplines. Perhaps teams could be set up to assure this very important function.

The laboratory provides a unique opportunity for students to gain experience with the skills that they have learned in other classes. Children learn best with concrete experiences; too often schools are content to deal in abstracts. One of the most important services which can be offered in industrial arts laboratories is to provide concrete experiences to students which will enable them to resolve the abstracts that they have gained from other classes.

Very often it is highly desirable to provide opportunities to students to supplement their required program of studies with elective programs which will dovetail with the goals they have set for themselves. I refer here to the pre-engineering student who is following an academic program and who would benefit from an industrial arts program in drafting. Also, vocational students in drafting might benefit from an industrial arts program in machine shop, and, conversely, the vocational machine shop student would benefit from an industrial arts program in drafting.

We have often heard that industrial arts provides the basic experience that will enable a student to be further trained on the job or by industry. Actually, less than five percent of the companies in the US, employing less than 30 percent of our work force, offer training programs, and even these generally insist on a certain level of vocational skill before trainees are accepted.

In short, our society demands a new type of school system – a failure-proof school system – where students of all sizes, colors and shapes will be accepted and provided with myriads of alternatives through which they may progress and move to higher education or to a productive job in society. Industrial arts and other skill-centered exploratory programs, together with vocational education, must provide a continuum of training and thus perform one of the most important functions of the modern day urban school. The phenomenon of our changing society presents us with new problems, especially when we consider that special emphasis must be made to accommodate the poor, the minority groups who once were absorbed by the mills, mines and railroads without any special skills. A school system which is able to cope with demands of such a diverse challenge presumes that the student body will be so large and the offerings so varied that programs will literally be tailor-made for each individual. Guidance must be continuous when the opportunities are so diverse and the picture is changing so rapidly.

We are reminded of the Greek myth of Procrustes, the fabled Macedonian bandit, whose specialty was capturing caravans and holding the people for ransom. His warped sense of hospitality insisted that all of his "guests" have a bed suitable for their size. If one of his "guests" was too short for the bed assigned him, he was put on a rack and stretched until he fit. If, on the other hand, the "guest" was too tall for his bed, Procrustes would have his legs chopped off.

It occurs to us that for too long too many of our schools have acted in the same way concerning our students. If a student is too big for our classes, we chop him down to size; if he doesn't measure up to our standard, we will stretch him, even to the breaking point.

It is hoped that the American public school system can adjust itself to the task of providing the personnel to offer programs that are relevant to the lives our students are going to lead. The problem is large; there is much to be done, but the resources are great. Our children are too valuable to waste. This will happen unless we are to accommodate their needs as they appear.

Dr. Kishkunas is Assistant Superintendent for Occupational and Vocational Education in the Pittsburgh (Pa.) public schools.

EDUCATIONAL MALNUTRITION

Howard F. Nelson

The philosophical problems of industrial arts and, more specifically, industrial arts teacher education have become vastly complicated by and inextricably interwoven with the rapidity and explosive ingredients of social and technological change. We have lived through an era in which free public education has been extended upward and outward until it encompasses nearly every American boy and girl. Never before in history has a major nation ever provided so much for so many. Not only have we made it available, but also we have insisted through legal decisions that what we have provided is good for all American youth.

For the most part, these kinds of decisions have been made without having clearly decided where we ought to go. In many cases, these decisions have led us to convictions that we ought to build more and bigger schools in which to keep more and more youngsters longer, although we are not quite certain what should be accomplished in the process.

Basically, our present philosophy stands firmly rooted in the belief that youth are supreme – that they are more important than the State or society. And thus, our responsi- . . is one of developing each individual to his fullest possible potential so that he may take his rightful place in society as an effective participant and producer.

Acceptance of this concept forces us also to accept the principle of individual differences among youth. And if we accept individual differences, we must also reject any tendency to expect conformity in the educational attainments and developmental levels of youth. The fact of individual differences assumes that youth must share in the responsibility for their own development and behavior and that these kinds of developments occur in interaction with peer groups. In practice, any good teacher will tell you that when you exploit all the unique capabilities of youth, you thereby make the task of teaching more difficult.

Now complicate this whole educational process by introducing the plethora of expressed needs and interests of youth. Rememb some students want and should go on into post-secondary education, some want but should not, some want not but should, some want not and should not and the rest don't really care one way or the other.

Add to this educational cauldron the important ingredient of general versus specialized education – the first of which assumes responsibility for developing the happy citizen and the second of which assumes the development of the good producer and worker.

This is an overly simplified, incomplete description of the educational arena in which some of us find ourselves today. At this point I might have proceeded directly into a discussion of the major problem areas about which I feel Council members ought to be concerned. Were I to do this, I would be addressing myself to the cozy, comfortable and uncomplicated educational environment of the typical suburban school, the experimental laboratory school or the otherwise limited-enrollment, financially-advantaged establishment school. This describes the relatively unperturbed environment for which most of the current curriculum projects have been designed.

Don't misunderstand me: most of these projects are excellent developments which demonstrate clear, ingenious thinking and great imagination on the part of the originators. However, these new approaches to the study of modern industrial and technological development are admirably suited only for the select clientele from the lab schools and the average suburban or otherwise financially independent schools, but they won't work elsewhere – at least not in their present form.

Not one of these new proposals would last a minute if introduced into a high school located about three miles north of this stage. Take any other project about two miles east of this auditorium and the students wouldn't even come to school, let alone study about industry and technology. Introduce a third proposal in a high school situated three miles south of this meeting place, and the students would throw both the originator and the project out the front entrance. Why is this true? It's very simple; in our search for respectability, we have made industrial arts completely "ivory tower" in its orientation, and, consequently, in its curriculum thinking and development processes.

Let me devote a few moments to review further some of the major thrusts of our membership over the last fifteen years. My memory serves me very well as I recall how teacher education became completely inebriated with the strong drink of the math-science-industrial arts kick. What happened at the time? In order to accommodate our

convictions that industrial arts should be one vehicle for learning more science and math content, we eroded many of its unique features and substituted artificial exercises in our pursuit of this goal.

Then we sobered up briefly only to imbibe again of the heady intoxicant of creativity. While under its influence, our major concern was to channel all industrial arts experiences in such a way as to enhance creative outcomes. In the middle of this binge, I wrote and delivered my now-infamous "Tombstones of Creativity" address at the Pittsburgh convention.

Following our adventure into creativity came the present ivory tower curriculum project development campaign; now we have perhaps as many as a dozen. Every one which I have read could become an excellent social studies supplement, but in no sense a substitute for the kind of industrial arts which is needed today.

While we have been fussing around, trying to help prepare scientific personnel to meet the original challenge of Sputnik, then getting agitated to the point of doing everything possible to push every able, affluent youngster ever faster and further, we have, by this very process, created a monstrous chasm between ourselves and great numbers of young people whom we have completely ignored. The gap separating the two groups has literally exploded into a canyon before our very eyes.

Suddenly (it seems only overnight – but in reality it has been building up for years), we discover that we have created inner city schools. Middle-class students have seceded from the common schools. The better administrators, teachers and money have all fled to the suburbs. This exodus has spawned these inner city schools which are now filled to capacity with a concentrated student population which deserves our understanding and attention, but in ways we have yet to envision. These kids are different from any you have known. Many are bright, reluctant learners who have grown up that way through an over-exposure to inconsequential education. They suffer from educational malnutrition from an under-exposure to meaningful experiences. They are poor achievers because they are possessed of negative self-images. They evidence a low evaluation of their own individual capabilities. Most have cumulative records of school failure, although they are not necessarily incapable. They have simply become fugitives from failure. They are from disadvantaged homes and environments, kids with mixed-up beginnings. Some have both parents, some have one, and the rest don't have anyone in the world who cares. Practically all come from homes where exist an outright hostility and indifference to education.

Yet, these are American youngsters – they are the future citizens, parents, workers, producers and taxpayers of tomorrow. I happen to believe that we have educational work to do to help these youth get ready to assume their future responsibilities. And what do these young people want? Pitifully little, really. Respect, understanding, a chance, an opportunity to be admitted to the adult world of work in which a stable job is the badge of admission.

Youth wherever you find them are beginning to discriminate sharply between relevant and irrelevant educational experiences. They are beginning to demand something out of education not necessarily produced by mere compulsory attendance. Is it too much to expect that relevant education might be an expected end-product of the educational process?

And so for this Council meeting of 1968, I expect to ignore the issues involved when preparing teachers for the suburbs, the lab schools and the other advantaged establishments, because as I see the picture now, the old, comfortable educational arena just "ain't what it used to be".

Perhaps one third of this audience comes from towns and small cities well separated from the major population centers, and thus assumed to be insulated, isolated and insouciant about the concerns which I have been voicing. However no one in this audience may plead non-involvement.

If any one of you tells me that you really aren't affected by these newly identified inner city educational problems, let me remind you that you are going to have to live for a long, long time under three major national commitments which have been written and adopted at the Federal level. First, we are going to eradicate poverty; second, we are going to remove all racial barriers; and third, we are going to educate everyone who can profit from formal education or training.

You and I can do very little about the first goal, except perhaps indirectly; we can and will do everything within our power to bring about the second; and, in my opinion, we better get on with the last commitment because we have no other choice at this time.

Now let me back up a bit and lay some groundwork for the remainder of my talk.

What has been the posture of members of this Council on some of the issues?

About five years ago, one of our outstanding teacher educators wrote an article about the potential, pre-vocational values of selected industrial arts offerings. He recognized at the time that many youth were not going on to post-secondary education, but rather directly into work, and that someone had to give them a reasonable amount of pre-vocational preparation. He expressed the view that industrial arts should do this because there simply were insufficient other programs to perform the service. That teacher educator was literally crucified from within and without industrial arts for daring to reach this conclusion. I want you to know today, that I took his side at the time in this organization and also within other groups. I still share his views.

A year or two later, when I served as your program chairman, I was thoroughly castigated by telephone for giving our Council program to the NAITE publication committee to appear as a pre-convention tear-out of that Journal.

I was severely criticized for giving a program about industrial arts teacher education to the publication assumed to be primarily concerned with vocational teacher education. Even though many of us hold memberships in both organizations, I was accused of "compromising" industrial arts by this action. Well, excuse me for what I am about to say – just how damn silly, sterile and spurious can we get and still stay in business? I think we are long overdue for a reassessment of our position on some of these matters.

It strikes me that the name of the game is unimportant, be it pre-vocational, occupational or industrial arts education. What is really important is to remember the boys and girls and keep their educational needs foremost in our thoughts.

Twenty years ago, the objectives of industrial arts made reference to certain pre-vocational values of the subject. At this point in 1968, I sincerely believe that we ought to climb down from our ivory towers to re-examine our basic objectives and ascertain whether there is educational work of pre-vocational nature which needs doing now. With about sixty percent of the average high school population falling in the category of the non-college-bound group, someone has to help them bridge the gap between school and the world of work if they are ever to become happy, useful, self-sufficient and productive citizens. I believe industrial arts has a responsibility in this situation. I believe we have to stand up and be counted.

I recommend here and now that Council members take the initiative and give leadership to the preparation of a new breed of industrial arts teachers who are competent to conduct pre-vocational or occupational education. I want a new brand of preparation which incorporates the study of a heavy component of relevant specialized education, plus many of the proven elements from our present programs. The student himself must have had diversified work experience of considerable depth and consequence, and if he doesn't, we must arrange for him to get it.

I envision a program which recognizes individual differences among teachers and makes provision for internal flexibility in requirements to enable the teacher educator to adjust the work to meet the individual's future needs and objectives. I want a program which depends upon demonstrated competence rather than upon courses and credits for graduation and certification. Such a program will necessitate intensive observation and practice teaching in an inner city school to minimize the educational shock encountered by the uninitiated. And I see the need for better motivating procedures to excite and challenge capable persons to serve these critical instructional needs.

Since I have been stepping on the sacred corns of industrial arts throughout this talk, I might as well go all out. I'm not a contestant in a popularity contest today.

In the broadened educational arena which now includes the inner city schools, what should be the role of the ACIATE members and how should they function in the preparation of future industrial arts teachers?

In a partial answer to this question, let me raise some specific questions which I will answer, and thus, express my personal convictions and, perhaps, biases:

(1) Should we become involved with the national commitment to educate everybody who can profit from formal instruction? I say, Yes.

(2) Should we come down out of the ivory tower and begin to face up to the critical instructional problems of 1968? And I say, Yes.

(3) Should we inaugurate an official dialogue with vocational educators concerning these new educational challenges? I say, Yes.

(4) Should we reassess our objectives and our current position with respect to general versus specialized education? I say, Yes.

(5) Should Council members generate more and better programs designed to develop

competence among graduates for the conduct of pre-vocational or occupational education? I say, Yes.

(6) Should Council members give leadership to the development of a new brand of curriculum, better suited to the needs of youth from the inner city schools, and, incidentally, for a great number of students from the establishment schools? I say, Yes.

(7) Should we consider calling our present junior high school programs industrial arts, our senior high school programs pre-vocational or occupational education and call all of the rest general education? I say, Yes.

Clarification of these kinds of philosophical problems clearly lies within the province of educational leaders. It remains to be seen whether we will accept this challenge, make the provisions and adjustments, or continue as in the past to expand and extend without delineating our goals. "Shall we contribute further to educational malnutrition even in industrial arts?"

As for the future, I wish we might be guided by James Thurber, who has told us, "Let us not look back in anger, nor forward in fear, but around in awareness." You can sharpen your awareness markedly by carefully reading Fantini and Weinstein, The Disadvantaged: Challenge to Education.

As the president of the American Council on Industrial Arts Teacher Education, let me state in closing that I am convinced the time has come for industrial arts to shed its pink play suit, put on a man's long pants, and get on with its share of the educational work which must be done. Thank you.

Dr. Nelson is Chairman for Industrial Education, University of Minnesota, Minneapolis.

W-6.1 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN TEACHER EDUCATION
Chm., Jake Reams; Rec., William E. Burns; Speakers, Jerome Moss, Jr., Jerry Streichler; Hosts, Holger E. Holmen, Allen Jensen.

CURRICULUM CONCEPTS FOR FUTURE TEACHER EDUCATION

Jerome Moss, Jr.

To dream about the future is fascinating; to think seriously about it is sobering; to reveal your predictions to colleagues is a folly that can turn out to be a nightmare. Nevertheless, it is important that each of us take time to look through his own colored, dusty and frequently cracked crystal ball in order to prepare for change. Teacher education, which should be the fountainhead of educational change, is too often its drainage ditch.

No one told me just how far to try to look into the future. For a while I considered the idea of attempting to describe the implications for teacher education of a social environment in which very few people have to work at goods production, where formal education is no longer a phase of life but a way of life, and in which the home is the primary learning center. Another possibility, perhaps a little less futuristic, is to envision educational cities or "youth quarters" strategically located within our megalopoli, wherein youth can fully integrate living and learning on a twenty-four hour schedule as a realistic introduction to adult society. Finally, I briefly considered assuming the availability of "enzyme-assisted instruction, protein memory consolidators (and) antibiotic memory repellers".(1) Although the implications of controlling the chemical elixir of intelligence and motivation are intoxicating, as was the idea of exchanging the teacher's shop coat for a pharmacist's jacket, I decided not to presume that we were ready to "needle" people to do better – literally, as well as figuratively.

Consequently, even though it might be less fun and a lot more compromising, the future of which I will speak is just about ten short years hence. Most adults will still be working for a living, communities will still have school buildings, and the educational psychologist, rather than the educational neurophysiologist, will still be calling the pedagogical "shots".

It is not possible to discuss the <u>content</u> of a specific teacher education program without some prior consideration of the role of the comparable program in the public school. Therefore, I did spend considerable time thinking about education in general, and what we now call industrial arts in particular, in order to set the educational stage and the role of the teacher-players we are to prepare. Since our teacher education programs are also greatly influenced by the teacher education models generally in vogue, these too had to be forecast. Thus, my description of our future teacher education program is based upon a hierarchy of prerequisite assumptions, which are themselves the products of perceived trends interacting with insidious biases. So that you won't be asked to accept the brainchild without sharing any of the joys of conception, a selected list of my suppositions will be provided.

Throughout, this presentation is long on generalizations and short on details; I would like to imply that this is due to severe time limitations, and to suggest that I was impelled by good pedagogy in order to stimulate you to fill in the details. The real reason, of course, is my own myopia.

Here, then, are seven assumptions about education in the years immediately ahead; each has implications for the role of industrial arts and for the preparation of instructional personnel.

First, a combination of social pressure, economic circumstance and more relevant curricula will serve to speed the development of post-secondary school facilities and to motivate most youth to take advantage of them.

Second, education will be increasingly articulated with work and leisure throughout life. Even during the elementary and secondary school years, the total community resources will be more fully utilized to provide planned learning experiences.

Third, the discipline orientation of curriculum development will yield to a coordinated (if not integrated) interdisciplinary approach. This wholistic perspective will result in providing more functional knowledge through emphasis on relationships between information and applications to human affairs.

Fourth, advances in instructional technology and administrative techniques, e.g., application of multi-media presentation and response modes to tutorial and dialogue systems of computer-assisted instruction, the non-graded school, flexible scheduling, etc., will permit a high degree of automated, individualized instruction. Teachers will have at their disposal a large repertory of materials from which suitable learning packages can be selected for each student; a variety of devices will be available for appropriate presentation; and the learning outcomes will be electronically evaluated in terms of prescribed goals.

Fifth, the development of curricula and curriculum materials will no longer be principally a local or even a state function. The major producers will be private industry and federally-supported centers.

Sixth, freed from the routine of dispensing information, teachers will be able to infuse the means of education with the humanistic values that we have hitherto wistfully espoused in defining the ends of education. The affective and conative outcomes – compassion, sensitivity, stability, self-determination, etc. – will become the realms of immediate, critical attention and concern of all teachers.

Seventh, and finally, revised instructional and other specialized tasks will demand differentiated teacher roles. Teams of teachers, each consisting of personnel with varying levels of competencies as well as kinds of subject-matter backgrounds, will help guide students through stages of educational development. The team also makes it possible to recognize salary differentials among instructional personnel based upon required competencies, and it will permit appropriate utilization of part-time and temporary, as well as career-oriented personnel.

As industrial arts educators, we will stop trying to build fences around shaky disciplinary claims. Our concern for maximizing the total functional contributions of education will force us to blur sharp distinctions, to break down unnecessary barriers among the practical arts, and between them and vocational education. We will cooperatively plan for and provide a continuum of occupationally-oriented education throughout the elementary, secondary and post-secondary schools.

This curriculum – call it occupational education for the moment – will be an activity program involving first-hand experiences in real or simulated work situations encompassing the full-range of occupational fields. It will be perceived by all educators as the vehicle for coordinating most of the formal educational experiences of youth. The social and physical sciences, the languages and arts, will all be made more relevant to the student's concerns by illustrating their occupational applications; these subjects will also be made more meaningful to students when opportunities are provided to apply their technological, sociological and esthetic concepts in planned occupationally-related activities.

Against a backdrop of increasingly individualized, automated and highly-verbalized learning modes, occupational education will offer special opportunities for small groups of students to utilize non-verbal learning aptitudes and to express figural and behavioral forms of creative problem-solving abilities in real and simulated work situations.

In general, with increasing student social and intellectual development, the occupational curriculum will provide an opportunity for a gradual increase in emphasis upon occupational content and greater occupational specialization. At developmental levels within the elementary school, for example, the primary role of the curriculum will be to facilitate learning the content of other subject areas, to begin to shape appropriate work habits and attitudes, and to create occupational awareness. At educational development levels in the secondary school, these same purposes will be continued. In addition, however, experiences will be selected from the entire occupational spectrum to acquaint <u>all</u> youth with a representative variety of occupations and their technical, psychological and sociological requirements, and to help students relate this information to their self-concepts and the vocational decision-making process. Of course, because of differences in learning styles and vocational objectives, students will be provided with varying amounts and specific kinds of occupational education experiences. At the post-high school level, content for occupational education will be chosen primarily to develop special vocational competencies in self-selected groups of students.

The preceding assumptions about the future of public education in general imply that

instructional personnel will become members of working teams. Teams will prescribe and "orchestrate" learning experiences, to take place both inside and outside of the school building; they will assess individual progress and diagnose learning problems; they will act as catalysts for small group and individual creativity; and most importantly, they will help to develop mentally healthy, self-determining human beings. In order to prepare teachers for these tasks, teacher education institutions will probably change their programs in the following general ways:

First, there will be an articulated blending of the pre- and in-service phases of teacher development. This will come about through partnership arrangements between teacher preparation institutions, school systems and other community educational agencies. The longer interface among these agencies will be facilitated by joint appointments of clinical professors, and, in turn, will permit a wide variety of practical experiences for prospective and new teachers, and provide a means for continuous interchange of innovative ideas and practices.

Second, the coordination of subject matter in the public school will be reflected in teacher education programs. Prospective teachers will learn to work in instructional teams and with a wide range of community youth agencies. Teachers will learn to relate their subject matter specialties to other disciplines and to apply them to problems and practices which are meaningful to youth.

Third, there will be an emphasis on helping teachers to build mature self-concepts and a sensitivity to the needs and values of others. They will also be equipped with tools and techniques helpful in developing similar maturity and perspectives in their future students. We will eventually be selecting teachers for teams and assigning teams to student groups on the basis (among others) of compatible personality patterns.

Fourth, teacher education programs will be designed to perfect sequentially the hierarchy of competencies required by most of the roles within the instructional team. For the most part, assistant and/or associate teachers will become staff teachers, who, in turn, may become master teachers. On the other hand, non-instructional technicians and clerks on the team, as well as members of the call staff (like clinical and social psychologists, artists and artisans), who serve at the team's request, will be prepared in a variety of other programs. Educational specialists in school management, research, curriculum development, diffusion, instructional technology, school psychology, counseling, etc., will also be needed, and will be trained in separate programs offered by teacher training institutions, often in cooperation with the private education industry.

Finally, unionization and the percent of minority group representation in teaching will grow rapidly. Teachers will gain increased control over all aspects of educational policy and practice. This power could represent a potential obstacle to change unless the professionalization of teachers incorporates flexible skills, amenability to change, and a personal value system oriented to public service.

And finally to our own teacher education program(2). The confluence of implications from anticipated changes in education as a whole, in industrial arts, and in general modes of teacher education makes it possible to estimate the characteristics of a future occupational teacher education curriculum. The prediction of teacher role and tasks has made it possible to infer required teacher competencies, which, then, permits hypothesizing a teacher education curriculum – the means by which competencies can be efficiently acquired.

The teacher education curriculum to be presented in this paper is limited. It is restricted, first, to the preparation of assistant or associate teachers who are specialists in occupational education on instructional teams in elementary, secondary and post-secondary schools; the preparation of non-instructional personnel, as well as staff and master teachers, is not covered. The scope of the description is also limited to major organizational characteristics, some attention to methodology and a survey of content; other facets of curriculum, such as facilities and staff, are completely ignored.

The total curriculum will be composed of blocks, each block to be further divided into smaller unit modules of instructional content. There will be a sufficient number of appropriate modules available to prepare a completely inexperienced high school graduate for any legitimate occupational education instructional role he desires to fill. Unit modules are the elements of each student's program. Tests will be available to measure the entry level competencies of students, in terms of unit modules and other learning characteristics, and computers will then assemble individual programs of study – combinations of unit modules – designed to prepare students efficiently for specific instructional roles. We will develop a classification system of individual difference variables and their inter-

action with instructional materials and modes of presentation. The contribution of each module to eventual teaching performance will be subject to continuous empirical validation. Progress through unit modules and blocks will also be measured by competency tests, and the appropriateness of each student's program will be periodically reassessed. The number of entry points to the curriculum will thus be limited only by the number of available modules, and the number of successful exit points will be limited only by the number of occupational education instructional roles required by teaching teams at various levels of student educational development within elementary, secondary and post-secondary schools.

One segment of the total curriculum array of blocks might generally be described as "techniques of occupational education"; it would include the methods and content peculiar to this instructional area. Although the emphasis will no longer be on teacher presentation of content, and much of the methodology to be taught will be integrated with the occupational content and teaching practical experiences, several blocks of unit modules will be formed to include topics dealing with the theory and techniques of (a) individual and group counseling, (b) the acquisition and dissemination of occupational information, (c) coordination, (d) cooperative work-study, (e) group dynamics, (f) discussion leading, (g) role playing, (h) sensitivity training and other "laboratory" methods, (i) social work, (j) laboratory/shop management and (k) enhancing creative problem-solving. Those prospective teachers who are preparing to work with disadvantaged students will also require instructional modules in the relevant aspects of special education.

Teaching candidates will be involved early and periodically in practical experiences. They will practice teaching in small peer learner groups; immediate evaluation systems of simulated teacher-learner interactions will be employed; periods of participant-observation in various school and community agencies will be used for role familiarization; upper division students will join the staff as team members for instructing lower division students; and finally, students will act as teaching assistants in a succession of instructional environments with students from different cultural backgrounds. The emphasis on teaching practically will undoubtedly increase the modal length of programs, but students will be paid at prevailing rates for their work as teaching assistants.

Another set of blocks will deal with the psychological and sociological aspects of work and occupations. Unit modules will be composed of content from occupational sociology, industrial psychology, economics, labor economics, industrial relations, marketing and distribution, business management, the history of technology, etc.

The fourth set of blocks contained within the "techniques of occupational education" segment will deal with the technical content of occupations. One block will provide an introduction, at the survey level and using school facilities, to the technology and work practices of categories of occupational families. It is in this basic block, incidentally, that students will receive their initial introduction to the teaching role. A second block, at the foundation level, will also use school laboratories to provide for possible recycling within a few occupational families in order to secure greater depth and specialization. A block of independent study and advanced technical units will be available for a third level of in-school occupational specialization. Visits, films, seminars with call staff, etc., will be employed throughout the three levels to supplement the prospective teacher's knowledge about the psychological, sociological and technical aspects of work. Finally, all students will undertake a supervised work-study block; the length of this block and the degree of specialization or variety it provides will be determined by the eventual teaching role in which the student expects to engage, and the occupational competencies he already possesses.

A second segment in the total curriculum array of blocks will deal with the "role of occupational education as a part of the public educational enterprise." It will contain blocks and unit modules of content drawn from the literature on career development theory, history and philosophy of occupational education and manpower policy formulation.

A third segment of available blocks in the curriculum will concern itself with the "problems of educational practice." One very large block in this segment will draw its module content from educational psychology, and will include aspects of the psychology of learning, developmental psychology, personality and attitude formation and the psychology of individual differences. A second block will contain topics on the history, philosophy, sociology and economics of education. A third block will cover organizational, administrative and curriculum development practices in education. A fourth and last block in this segment will deal with instructional technology; it will familiarize students with the nature of available instructional devices and techniques, and prepare students to

use them properly in evaluating, diagnosing and prescribing for student learning.

The final segment of blocks in the curriculum is commonly known as "general education", at least as interpreted for its value in education. Blocks will be available in mathematics, the physical sciences, the social sciences (including cultural anthropology and economics), the humanities (including history), communications (written and oral) and the arts.

As individual students are scheduled into the same unit modules, they will ordinarily be organized into learning teams of from two to eight persons. Small group activity, both in the laboratory and in discussion, will be the mode. Flexible scheduling procedures, however, will make time available for individuals to utilize computer-assisted instruction, tutorials, independent study, etc. It will also permit medium-sized groups to meet in departmental seminars in order to discuss the interrelationships among their in-school and out-of-school experiences, and among the various blocks of work in which they are engaged. Service blocks for students in other educational fields, and frequent interdepartmental seminars, will also make possible the exploration of relationships among various subject-matter areas, and the development of ideas for their coordination.

In closing, let it be understood that I do not believe that I have introduced you to any new ideas. At best, I may have helped to organize those you have already had, heard or read into one, hopefully logical, pattern. But after all, I have attempted to describe our program as it should be only ten years from now. If I am right, it's about time some pioneers were actually starting programs like it!

FOOTNOTES

1. Kretch, David, "The Chemistry of Learning", Saturday Review, January 20, 1968, pp. 48-50, 68.
2. A number of ideas expressed in this section were originally contributed by Dr. Robert Randleman and my other colleagues in the Department of Industrial Education at the University of Minnesota.

Mr. Moss is Professor of Industrial Education at the University of Minnesota, Minneapolis.

W-6.2 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES RELATED TO THE SUPERVISION OF INDUSTRIAL ARTS
Chm., Herbert Siegel; Rec., Jack Reynolds; Speakers, Jarvis H. Baillargeon, Robert E. Blum; Host, Richard Froese.

THE DEVELOPMENTAL APPROACH

Jarvis H. Baillargeon

The developmental approach is an attempt to structure a portion of the realm of technology into a package that can be used in the classroom. I think it is important for the emotional well-being of the teacher that he have the security of a strong philosophical approach into which all levels of industrial arts education can interrelate, as well as having a usable package of instruction.

This approach centers on people, on their sociological needs and on their psychological needs; without satisfaction of these needs, we cannot function effectively.

There is need for the identification of a simple and a specific goal. The goal identified here is a single goal for the entire discipline of industrial arts education. A goal of technological adaptability relates equally to urban, suburban and rural population needs. Technological adaptability opens the doors at all ability levels. Technological adaptability provides focus for the general objectives of industrial arts education as we now know them. Technological adaptability can be a standard for basic industrial arts education for the years ahead.

We should consider Bloom's educational taxonomy and its relationship to our own discipline of industrial arts education: (1) The cognitive domain, meaning the concepts, the generalizations, the understandings, the facts of our subject; (2) the affective domain, involving purposeful manipulative activity as a foundation upon which a variety of cognitive knowledge and affective attitudes can be built; and (3) psychomotor activity, with an emphasis upon "hands on" activity, actual physical involvement with tools and materials. These three domains have curricular meaning for us.

There are levels in our endeavors. I have chosen five that seem to apply most directly to the manner of organization of the schools in New York: (1) The primary level, which I have arbitrarily set at grade levels K-4; (2) intermediate grades, 5 and 6; (3) early secondary grades, 7 and 8; (4) secondary grades, 9-12 and (5) continuing, post-high-school education. I now identify a flow structure beginning with the Nature of Work in primary grades, the Introduction to Tools in intermediate grades, Examination of Materials and Forces in the early secondary grades, Orientation to Industry in the secondary grades and Extension of Abilities for continuing education.

There is a need for an awareness by young children of the nature of work. Instruction would involve classroom discussions, field trips, instructional media, all with an emphasis upon people in their roles as workers, and primarily upon service for the products of industry. For primary grades, classroom activities would provide an awareness of people, work and products.

Intermediate grades, grades 5 and 6, are now appearing as initial grades in the middle school. Here activity can begin in a shop/laboratory with attention given to the introduction to tools. Children of this age are very group-oriented and achieve great satisfaction in working as members of group projects, sharing in the satisfaction as part of a group.

Dr. Bonser, at Columbia, stated years ago that man's endeavors related to food, clothing and shelter. Shelter (construction) is a field which should receive attention in Grade 5. The buildings in which we live and work, from frames to domes, should be part of a student's background.

The field of transportation is a fourth major category of man's endeavors without which our society cannot exist. It is just as basic as food, clothing and shelter, and without it we would have to go back to the level of the Australian aborigine. Grade 6 students should receive instruction focusing on man and his means of transporting himself and his material goods: the vehicles, the patterns, the materials, the mechanics of transportation.

In the early secondary level, grades 7 and 8, the focus is upon the examination of materials and forces. Primarily it involves a general shop for grade 7 including woods, ceramics, plastics, drawing and line production, and a differently equipped shop for grade 8 involving the activities of metals, graphic arts, electricity and power mechanics.

The secondary level would present an orientation to industry, consisting of two series of elective courses to be offered to all students in grades 9-12: the Basic Series for average students, the Technology Series for high level students, focused upon a goal of technological adaptability, not depth of instruction, but breadth of instruction.

The Basic Series should include mechanical drawing, metals, power mechanics, woods, electricity-electronics, graphic arts, plastics and ceramics. The Technology Series should include engineering drawing, power technology, production technology and graphics technology.

We have reviewed two of the elements, Domains and Levels, which I believe are involved in industrial arts education. Now let us consider the third, the Functions common to all industrial arts courses.

I have tried to isolate a number of functions which seem to be common throughout all phases of industrial arts education: (1) Planning-design, (2) research-development, (3) industrial organization, (4) products-services, (5) materials-fabrication, (6) tools-machines, (7) processing-assembly, (8) element testing, (9) career guidance and (10) avocational. These are not meant to be weighed. It is not inferred that each of the ten means ten percent of something. It simply means that these are common functions that should appear on every level, in every course, of the discipline of industrial arts education. Relating the three elements – domains, levels and functions – is a method of developing curriculum. It establishes the principles upon which a course of study can be built.

I believe that the total instructional package should involve 25 percent formal instruction and 75 percent psychomotor experiences. Have you ever counted the actual minutes that are available in a one-year course? More than 8,000. Show me a teacher's course of study, high school or college, that outlines 2,000 minutes of instruction! Draw up a list of one hundred 20-minute lesson presentations that includes some of each of the

functions I outlined, and you will have a good course of study without exceeding a reasonable balance.

I think we are in trouble with our ideals. We have a problem of identification for our teachers. We need acceptance as a discipline; we need to emphasize our mission and our goal. We know that performance is only possible by doing, and if we are to improve the performance of our citizens, we must improve the "doing" within our courses. The acquisition of theoretical knowledge alone will not meet the demands of our culture. Book learners who cannot perform are culturally impaired. The study of technology is not an historical exercise; it is participation in the most important realm of human knowledge. After a student has been involved in our discipline, his adaptability will make him a more productive and adjustable human being.

Mr. Baillargeon is an Associate with the Bureau of Industrial Education of the New York State Education Department, Albany.

EVALUATING CURRICULUM INNOVATIONS

Robert E. Blum

Today education is facing the challenge of many new pressures. Many groups are demanding a greater share of the educational decision-making responsibility on local, state and national levels, and education has grown to a point where giant corporations are considering the advisability of entering the education business. In addition to large corporations, many smaller enterprises are being established to develop and provide educational products. These endeavors are being referred to as the "knowledge industry". The products and services provided by the knowledge industry vary widely, from electronic equipment to testing services to program planning. The flow of equipment, materials and services from the knowledge industry is increasing at a rapid rate.

To date, the effect of the knowledge industry upon industrial arts has been minimal. We have been exposed primarily to the promotional efforts of textbook companies and equipment and materials suppliers, and their efforts have been primarily toward a gradual change in their offerings. The fact that we have been sheltered to a great extent from the effects of the knowledge industry will not hold true in years to come. Educators, as well as other public officials, are becoming more aware of the great need to include technological education in the school program. Industrial technology must become an important part of that education. Individuals in decision-making positions are also realizing that most current industrial arts programs are falling far short of providing our young citizens with an adequate understanding of industrial technology. Industrial arts programs are not doing all that is possible to aid individuals in understanding, fitting into and coping with our complex industrial society.

Even though programs are included under many different names, such as occupations, vocational, technical and industrial arts, the total amount of public and private funds available for innovative and improvement purposes in the field of industrial technology is rapidly increasing. Those who grant such funds expect changes in existing school programs. The amount of change varies from upgrading the curriculum in a single school to establishing totally new programs with the potential for widespread adoption or adaptation. I am not here to tell you that large development projects are the only worthwhile efforts, nor would I tell you that only locally developed innovations are meaningful in terms of local goals. I believe that development efforts at all levels are valuable and may be useful in improving your programs. I am here to suggest that you, the industrial arts supervisors, are in a position to seek information about all innovations in the field of industrial arts and to evaluate them in terms of the needs of your school district. In fact, I believe that you are obligated to become aware of all innovative efforts in our field and to utilize every available idea or instructional material in developing the best possible industrial arts program for your schools.

Today I will present a model for identifying, trying and evaluating curriculum innovations in the field of industrial arts. At the same time, I will present a few ideas on two crucial concerns: (1) when to try curriculum innovations and (2) some criteria to be utilized in measuring their success.

A good deal of research is being conducted in the area of the change process in education. Resulting from this research are many models of the change process, and one such model, shown in Figure 1, was developed at The Ohio State University by Guba and Clark (1). This model places the responsibility for development, diffusion and evaluation upon the developing agency which generally is the knowledge industry. There is nothing wrong with this model; however, I would like to recommend a model which places the responsibility for identifying, trying and evaluating curriculum innovations upon local school districts. In most school districts, there are no persons better qualified to assume this responsibility than the members of the supervisory staff.

The initial phase of the process as shown in Figure 2 is identification of innovations. I am suggesting that you as the industrial arts specialist in your school district actively seek to learn about unique programs which may have application within your district. A continual review of the literature in our field, a program of visitation to other school districts, and discussions with other supervisors, commercial representatives and teachers should result in the identification of any number of innovations. Perhaps this organization, The American Council of Industrial Arts Supervisors, could sponsor a massive identification program which would result in a publication entitled, "Innovations in Industrial Arts." Such a publication could include an annotation of all innovative programs along with the names of the developers and a source for information about each innovation included.

If a concerted effort is made to identify unique programs, the number found will be vast. A single district will not possibly be able to try every new program discovered, and this means that some preliminary screening must be done. The screening should probably be based upon the potential program improvement which may result from use of the innovation. How well do the rationale and objectives of the new program fit the philosophy of the district? What gains toward accomplishment of district goals may be gained from the innovation? In addition to the philosophical questions, some developers may provide information about program performance. Some data about student achievement, feasibility and program specifications may be available; if it is available, it should be considered in the preliminary screening. The preliminary screening should involve not only the supervisory staff, but this stage should also involve a committee of the local industrial arts teacher organization.

After an innovation has been accepted for trial and evaluation, the next step is to identify a school in which the administration is willing to try the new program. Also the school should have a teacher who is eager to teach the program. If a school is interested but the teachers are not, staff assignments may need to be revised.

At the same time, an evaluation program should be outlined and the evaluative instruments should be designed. It will be necessary to determine what evidences of program feasibility and effectiveness are desired and to establish the procedures for collecting the supporting data.

An innovative program which is selected by a school district for trial in the district should be given every chance for success. A new program may fail because of lack of merit, but it should not be allowed to fail because of a lack of program support. The necessary support begins with the selection of school and personnel and must continue through the next two phases, (1) preparing the environment and the personnel and (2) conducting the program. Preparation of the environment and the personnel may be done by the supervisor and the individuals to be involved in the trial, or it may be done by consultants from the developing agency. Every consideration should be given to preparation prior to initiating the program, and the preparation must continue throughout the trial.

During the conduct of the program, the teacher should receive an unusual amount of assistance and encouragement. He will most likely be dealing with new content, new methodology, or both and will need special consideration. While the program is in operation, data will be collected for the purpose of evaluation.

Evaluation should take place during the entire trial period: however, a decision should not be reached until the trial has been completed and all the data have been summarized and analyzed. At this point, teacher representatives, the supervisory staff and administrators should decide whether to adopt, adapt and adopt, adopt and continue on a trial basis, or eliminate the innovation.

To summarize, the three major phases of processing curriculum innovations within a school system are identification, trial and decision.

This brings us to the discussion of when to initiate the processing system and what to evaluate. In planning for a continuing program of improvement within a school system,

it is necessary to place phase 1, identification, into operation immediately. This can be done by individual districts or by a leadership organization such as the American Council of Industrial Arts Supervisors. It may be as simple as interviewing neighboring districts, or as complex as conducting a nationwide inquiry program. As screening takes place, it is important to note the developmental stage of each innovation. Some new programs will already have been field tested several times and be part of an ongoing program, while others will be in their initial field trial. It is very important that no innovation be selected for local trial until the developers believe that it is ready for adoption or adaptation. I will emphasize again, you should not attempt local trial until the innovation itself as well as support programs are available from the developer or some other source.

Criteria for Evaluating Curriculum Innovations

Both in the preliminary screening, if the data are available, and in the evaluation of the local trial, the program must be judged against preplanned criteria. The specific criteria will vary somewhat with the school district and the nature of the program. There are some general areas which probably should be considered in the evaluation of every curriculum innovation. Several general criteria will be presented and discussed briefly.

The philosophical basis for the innovation. From what rationale did the innovation grow? Is it a narrow viewpoint which tends to limit the program content excessively? Is the rationale so broad that the program wanders from a study of industry? Do the program rationale and purpose dovetail with those of your school district and industrial arts program? The answers to these plus many similar ones will aid you and your staff in determining philosophical suitability of the innovation in your district.

The suitability of the innovation for the students. More and more, programs are being planned to meet the needs of specific groups. Generally, an innovation will be related to students of a certain age and ability. Once this is known, several questions can be asked in determining suitability. Can the students read and understand the information? Is there an appropriate amount of in-class and out-of-class work? Are illustrations and examples meaningful to the students? Can the students perform the motor tasks required by the program? Do students feel a sense of accomplishment from the program? Are students interested in the program?

The adequacy of the development process. Study of the procedures used to develop the innovation may reveal the answers to several important questions. How was the content structured? Who was involved in structuring the content? Is the content complete and technically accurate? How were the learning experiences selected and developed? What quality control procedures were used during the developmental process? Was the innovation field tested and revised? How was it tested? Many programs may look good on the surface, but an understanding of the developmental process used may reveal extreme weakness in the program.

The required teacher characteristics. An innovation may seem to be excellent, but it takes a highly-skilled and knowledgeable individual to teach it. How feasible would a program for average students be if it required an electrical engineer to teach the course? In most school districts, any innovative industrial arts program which is to gain widespread use must be taught by the existing industrial arts teachers. What new knowledge will industrial arts teachers need to teach the course? What new teaching methods are included in the program? Are the teachers interested and enthusiastic about the innovation? Does the new program threaten the teachers? The teacher is the most critical variable in program success, and unless the teachers have either the skill and knowledge required by the program or make provisions to prepare themselves to deal with the course, the innovation will fail. This brings us to our next criterion.

The installation support available. In initiating a new program even for trial purposes, support from the developer is essential to success. Are instructional materials available? Are consultant services available? Is teacher preparation, both pre-service and in-service, available? Are facility designs available? Answers to the above questions will provide a general understanding of available support.

The adaptability of the innovation to your school district's operating procedures. An innovation which will not work into your district's operating procedures without overhauling the operating procedures is generally of little value. What is the basic planning unit-day, week, semester? How much time is required to conduct the program? Is their innovation highly structured or very flexible? And (probably the most important question in this category) how difficult will it be to adapt the innovation to your system?

The initial and recurring costs of the innovation. What facilities are required? What

tools, equipment and materials are required? What percentage of the tools, equipment and materials are currently available in existing laboratories? What percentage of the materials will be re-usable? What will the instructional materials such as textbooks and teaching aids cost? Every school administration will require that costs be determined either before or during the trial, since economic feasibility is a primary concern of public schools. You should not assume that an improved program will cost the same as or less than an ongoing one; however, additional expenditures required should not be excessive.

The success of the innovation in terms of student achievement. The last criterion to be mentioned is far from the least important. Are program objectives accomplished? What percentages of students are able to perform the desired tasks as a result of the program? What percentages of students are able to demonstrate knowledge and understanding of important concepts? The whole idea of utilizing student achievement data to evaluate the effectiveness of a program is badly neglected, and we in the profession must do all possible to bring this important aspect of evaluation into use.

I have presented the basic tenet that school districts, under the leadership of dynamic and responsible supervisors, must aggressively seek to identify curriculum innovations which may be useful in improving local industrial arts programs. Three basic phases are included in a system for processing innovations within a school district, including identification, trial and decision. The decision regarding acceptance or rejection of an innovation should be based upon several criteria, including (1) philosophical basis for the innovation, (2) the suitability of the innovation for the students, (3) the adequacy of the development process, (4) the required teacher characteristics, (5) the installation support available, (6) the adaptability of the innovation to your school district's operating procedures, (7) the initial and recurring costs of the innovation and (8) the success of the innovation in terms of student achievement.

We must improve industrial arts. You are in a position to act. Please do.

FOOTNOTE

1. Clark, David L. and Egon G. Guba. "An Examination of Potential Change Roles in Education." A paper presented at the Seminar on Innovation in Planning School Curricula, Airielhouse, Virginia. (Adapted)

Dr. Blum is Assistant Professor of Education at the Ohio State University, Columbus.

FIGURE I

A CLASSIFICATION SCHEMA OF PROCESSES RELATED TO AND NECESSARY FOR CHANGE IN EDUCATION

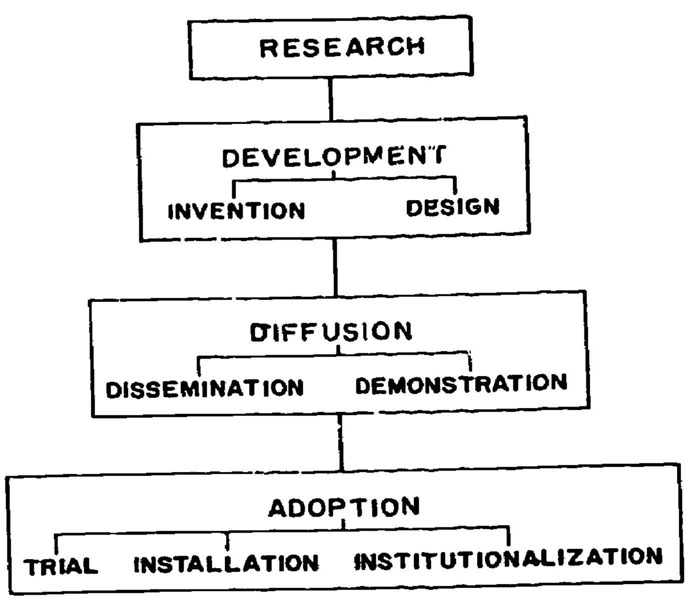
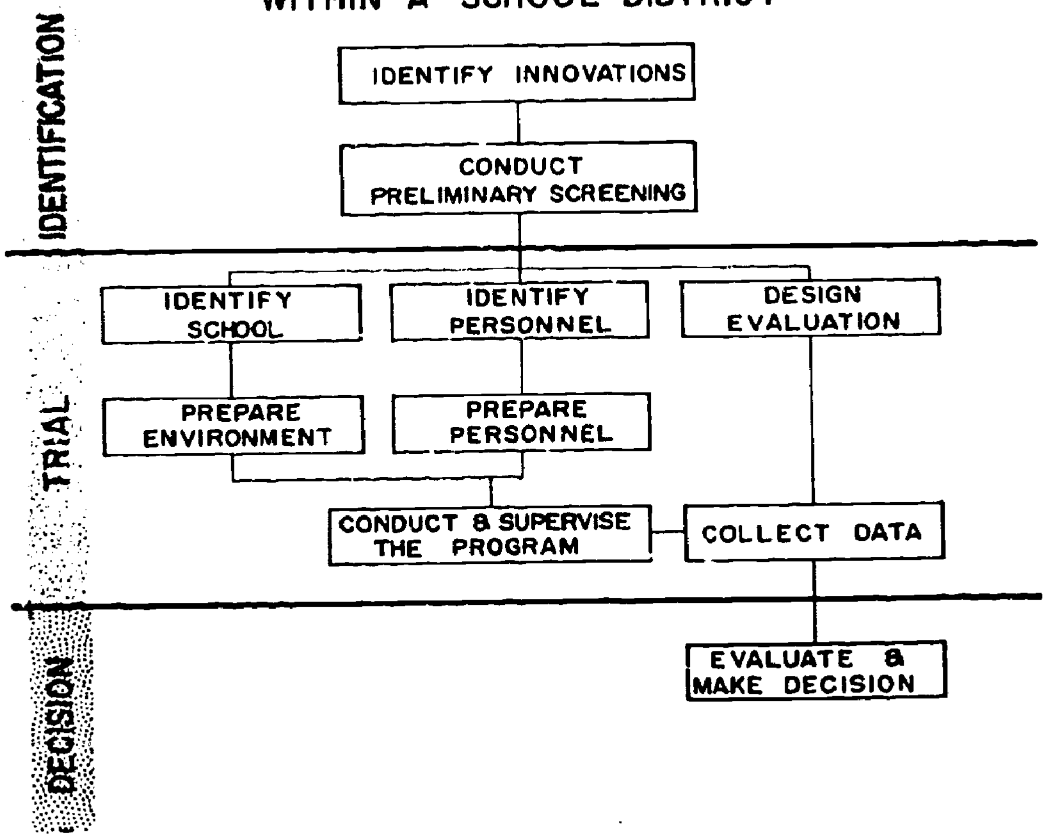


FIGURE 2

MODEL FOR PROCESSING CURRICULUM INNOVATIONS WITHIN A SCHOOL DISTRICT



W-6.3 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN ELEMENTARY SCHOOL INDUSTRIAL ARTS
Chm., Harold Gilbert; Rec., Alvin E. Wutti; Speakers, William E. Warner, William Pugh, John Borgeson, William R. Hoots; Host, C. J. Koleznski.

CURRICULUM CONCEPTS FOR ELEMENTARY SCHOOL EDUCATORS

William R. Hoots, Jr.

Few would argue with the statement that "elementary education is the most important of all levels of education." It is at this level that the foundations for future learning are formed, and attitudes toward learning, the school and society are developed.

Needs of the Child. The basic purpose of education is to acquaint youth with the nature of the culture in which they live. Our educational system is dedicated to providing an opportunity for every child to prepare himself to the fullest extent of his ability to become a productive adult in contemporary society, and to develop intellectually and culturally in order that he might appreciate and enjoy the full meaning of life.

Today's American culture is distinctly and uniquely technological. Technology is defined as being the result of the interaction of man, mind, materials and energies; it is man controlling nature and man mastering his environment. Technology is the origin of science, and theory is developed only when man attempts to solve a problem and becomes involved in the interaction with mind, materials and energies. Technology is the force which produces revolution in culture, that force which produces cultural change.

This is a brief characterization of the world into which children must be prepared to enter, a world complex, confusing and often frightening to many adults who have had a part in its creation. We cannot expect the child emerging after twelve years of immersion in abstract subject matter to be able to cope adequately with this kind of an environment. We must begin at the beginning of his educational experience to develop a solid foundation upon which the skills and understanding necessary for effective living can be formed.

Elementary Industrial Arts Defined. Industrial arts is that segment of the school curriculum dealing with the study of technology. It has the responsibility of acquainting youth with the nature of our technological culture and assisting them to discover their place in it.

Dr. Delmar Olson describes the benefits of industrial arts education in terms of functions. The social function aids in the development of self-expression and personal competencies. The cultural function is concerned with development of understanding and appreciation of the American culture as it has been influenced by man's mastery of materials and his efforts to control his environment through technology. Social changes in our culture have provided man with more and more leisure time, and he is in need of wholesome activities with which to fill this time. Industrial arts can help youth to understand this phenomenon and to cope better with problems related to it, while providing skills appropriate for leisure time use. The consumer function provides for an enlightened utilization of the products and services of technology. The occupational function of industrial arts provides an orientation to the ways in which man earns his livelihood in occupations involving technology. The technical function acquaints pupils with tools, machines and processes by which man has improved his welfare in his attempts to master his material environment.

In addition to these functions, industrial arts has an aesthetic value, for through the study of technology, pupils develop an awareness of the wonders of life so often taken for granted.

The Program. Textbooks for the elementary grades are filled with information related to industrial technology. Authors of these books are aware that there is a vital need for children to learn about this phase of their culture, and they have included information about technology and its influence on living. Children in many of today's schools read about this phenomenon of our culture, but most fail to develop an understanding of it. References to technology now present in many elementary school textbooks should be stressed, in order that industrial arts will be a part of the curriculum for every child. An emphasis should be placed on the elements of technology that currently appear in textbooks, and the use of the manipulative technique of teaching in the industrial arts laboratory.

This program should have specified units of study for each grade developed around specific objectives, and the material covered should build on that presented in lower grades.

A curriculum currently is being developed by extracting all references to industry or technology from selected elementary textbooks, categorizing the various elements, and developing an industrial arts course of study from them. This will provide a definite sequence of learning experiences for grades one through eight that will be correlated with the whole elementary curriculum.

Staff. One of the problems of staffing an elementary industrial arts program is that teachers in the elementary grades do not have appropriate background, preparation or experience for this kind of program. They have come through a sheltered academic environment and know little about the world of work for which they are preparing children. Their total environment has been academic; this is the world they know, and this is the emphasis they place through their teaching. Although the majority of our children never go to college, these teachers are preparing youth to perpetuate the academically oriented environment of our educational system.

Conclusions. The educational program for children in today's elementary schools needs a reorientation toward their real needs in today's society. Society is changing too fast, and future adults must be prepared to live in a highly complex technological environment. The challenge for change is to school administrators, teachers, parents and all who are concerned that children receive a functional education.

Industrial arts in the elementary school will go a long way toward preparing children for our technological environment. Through this instruction they will develop skills for selecting meaningful and satisfying employment, for intelligent use of technological products and services, and abstract subject matter from other disciplines will be more

meaningful. With industrial arts education, tomorrow's children will be able to lead a happier and more productive life.

Dr. Hoots is Associate Professor at East Carolina University, Greenville, North Carolina.

W-6.4 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM COURSES IN METALS
Chm., Herbert A. Anderson; Rec., John J. Humbert III; Speakers, E. H. Dixon, Douglas T. E. Foster, Roger Hoover; Host, Edward J. Richards.

MODERN INDUSTRY AND THE METALS CURRICULUM

Douglas T. E. Foster

The two factors which have probably had the greatest affect upon our metals curriculum are the attempt to make industrial arts a part of the general education of all students and the effort to update the programs to keep pace with advances in industry and technology. In the first instance, we found we could not reach all the students of a large comprehensive high school, having a student body of between two and three thousand students, with only five or six industrial arts facilities capable of handling a total of four to six hundred individual students. We therefore experimented with large group instruction, special afternoon classes, full-time use of all facilities, and special related programs with other areas of the school curriculum. We feel we are having some success in presenting modern concepts to more students and instilling facts which will help them analyze problems presented to the average citizen through news media, to arrive at a better understanding of the technical society in which they will live.

Unfortunately, however, there seems to be a much more important problem for us to examine and attempt to rectify. In a survey conducted in February of this year, involving both large and small metalworking organizations throughout the United States, seeking to determine industry's reaction to the question, "What can the secondary schools do to better prepare young people to enter the metalworking industry?", the following comment was very common, and although stated in many ways, this quotation from the training director of a large Cleveland machine tool manufacturer seems to sum it up:

> "I feel there is a pressing circumstance which, in the last five years, has become such a serious problem that it is now imperative to direct a great deal of attention and effort toward effective remedial action. I refer to the number of young people who do not understand the 'concept of work', whose attitude and motivation are so poor that they have become one of industry's most serious production handicaps. More and more of our young people are entering employment with wrong attitudes, poor work habits and a definite lack of motivation. The reasons for this are many and varied; however, some new techniques or approaches must be developed to combat this growing undesirable attitude of our young people. The carelessness, indifference and irresponsible attitude toward the world of work is spreading like a cancer. If you can accomplish any improvement in this area, the results will be most beneficial to everyone concerned."

Could this be a problem of our society in general? Have we lost the most important sense of values? Should it be a vital part of our future curriculum planning to be sure that a greater effort be made to improve these concepts and attitudes?

We have enlarged our scope so as to include six different classifications of students: (1) the young man who plans to go on to a four-year college, (2) one who plans to attend a junior college or technical school, (3) a capable student who has no desire to continue his formal education, but wants to go to work as soon as he graduates (if the draft board will allow him to do so), (4) the less capable student who must obtain employment upon gradu-

ation, (5) the limited student (sometimes classified as a "special education student") within whom we must try to develop some "salable skills" so he may be able to earn his own living and not depend upon charity, and (6) the often-forgotten young ladies who very seldom enroll in industrial arts programs, yet seek industrial positions immediately upon graduating from high school.

In reviewing the above students it is obvious that group (1) will probably become engineers or scientists, (2) technicians, (3) good machinists or machine specialists, if an apprentice shop or good training program were offered by employers, (4) good operators, (5) workers who may perform operations of a highly repetitious nature or simple assemblies, and (6) specialized operators whose work requires high dexterity, inspection or quality control.

The survey also illustrated other significant points. The general consensus was, "A good working knowledge of tools and basic machinery, including the applications of numerical controls, is sufficient; we want to do the training beyond that level"; and, "We find the better students continue with schooling beyond high school. Of those left, we have found only a small percentage who have satisfactory arithmetic and mechanical knowledge or have ability to communicate in a satisfactory manner either orally or on paper."

The above comments are exactly the same, with the exception of the reference to numerical control, that the author received in a survey conducted in 1948. What have we been doing during the past twenty years to improve our product, the high school graduate? Many may say it is not the responsibility of an industrial arts department to prepare young people for employment. They would like to pass this over to some type of vocational school, but we must remember that all students do not have access to good vocational schools and that many students still feel it important to receive as complete a comprehensive education as possible through the high school level at least.

We may easily meet the needs of groups one and two by large group instruction, special afternoon classes, visiting lecturers who may speak on particular types of industries and their problems, research problems and field trips; but we must plan modern curricula for groups three, four and five, and we must strive to make our programs more available to group six. Many of our schools will find it financially impossible to install numerical control equipment, but the principles may be covered in a classroom or laboratory, and field trips to nearby manufacturing plants, using numerical control, may be arranged to illustrate its practical application. In some rare instances, it may be necessary to resort to films or other visual aids. However, it is possible to give everyone in these latter four groups a better set of concepts relative to the importance of mass production in our technical society; the great need of developing safe habits in and out of the shop or laboratory; the need of a new outlook by our society in general, toward the values which seem to be overlooked by too many of our young citizens; a sound background in, and a working knowledge of, tools and basic machinery; and a sincere desire to develop their own potentialities to the utmost. Advantages of mass production to lower the total cost of a manufactured item have been successfully illustrated in some industrial arts facilities by planning a salable project, establishing a model company, engineering the most economical method of production, routing the required parts through various operational stations, inspecting, assembling, packing, advertising and selling. The ultimate selling price is an ideal place to contrast what the price would have been if each part had been machined as an individual part. Here the instructor may also illustrate how the overall cost of a similar item could have been further reduced by an industrial plant using modern foundry methods, production sheetmetal fabricating processes, numerical control equipment, multi-spindle automatic machinery, production welding methods and production-line assembly techniques. It is most imperative to discuss the problem which usually arises at this point, the threat of automation to the number of employment opportunities in the area in which it is installed. After talking with men in automated industries, you can select items to illustrate how we have been improving our production methods since the time of the industrial revolution by "leaps and bounds", methods which resulted in more and more employment, with the working man spending fewer hours at an easier job for more money, and able to enjoy a far better standard of living, and more luxuries and leisure time than any of his counterparts in any other country on earth. True enough, automation may cause changes in occupational assignments, as we are told by the Department of Labor projections, but this gives us all the more reason to be sure each student has a sound background of good general education rather than a narrow or single vocational specialization.

All respondents to the survey questionnaire stressed the need for more mathematics

(algebra, plane and solid geometry and trigonometry); physics, so each student is well grounded in the basic laws and science of matter and energy; and language, to enable him to communicate orally and in writing. There seems to be a nation-wide problem of educating the college-bound and forgetting to give the important essentials to the student who has not as yet found a good reason to study or who "has not been properly motivated". Is it possible that in this day of "educational excellence", the industrial arts supervisor and teacher is the only one who can appreciate the needs of a large majority of most comprehensive high schools? Furthermore, is it possible that they are the only educators who will revise some of the archaic methods of teaching and apply a more practical approach so these students will be able to learn at least enough of the fundamentals of these subjects so they will be able to apply this knowledge to everyday problems in the shop, and at some later date when they have gained a little maturity and good judgment, use this meager foundation to build a better understanding of each subject to advance to better positions in their chosen field?

We have tried to have classes established in the academic departments, but we do not meet with much success because many of the academic teachers find it difficult to separate the practical from the established curriculum, or to give practical applications to any given type of problem or theory. Therefore let us give some thought to larger industrial arts facilities, equipped with a planning or theory room and two teachers, thus enabling us to open laboratories to more students, cater to the needs of students at all levels, and teach the type of mathematics, science, English and human relations that the students need in order to be more successful in modern industry.

Mr. Foster is Assistant Professor at Rhode Island College, Providence.

INNOVATIONS IN METALWORKING

Roger Lee Hoover

Professional educators at the local, state and national levels have widely accepted the objective of industrial arts which aims at giving an insight into and understanding of industry. It is evident by the attendance at this meeting and by a majority who have attended this conference, that this objective is widely accepted.

Industry is very difficult to define. It is constantly changing. Industry is composed of tools, processes, men and machines – all of which work together to transpose materials into useful products. These elements – the tools, processes, men and machines – are constantly being modified to increase productivity.

Rather than defining industry, it might be easier defining what it is not. Industry is not the handmaking of dove-tail joints, linoleum block printing, line weights on cross hatch patterns, birdhouse construction, or even the polishing of metal by hand with abrasive cloth. Many of these topics are common to some of the instructional units in present courses.

In contrast to industry, industrial arts instruction has not been forced to change. It would be beneficial if it could and would reflect the many industrial innovations. Industrial arts has tended to freeze instruction on tools, materials, processes and machines, thereby taking the industrial representativeness out of the discipline. If this stalemate continues, the discipline of industrial arts as we know and respect it today will lose its place in general education.

What are some of the innovations in metalworking that have industrial representativeness sufficient to command a place in our curriculum? Possibly these innovations would be more meaningful if reference was made in terms of categories of either tools, materials or processes.

Recent innovations in metalworking tools include: ceramic, oxide, diamond, lasers, lightwave interference, ultrasonics, refactory clay materials, oxidizing chemicals and de-atomization devices. These tools have added new dimensions to the metalworking industries.

Recent innovations in metallic materials have for the most part resulted from new alloying techniques. Increased usage of such elements as titanium, nickel, aluminum, tungsten, beryllium, cobalt, magnesium, zirconium and other space age metals has

resulted in metallics with far differing characteristics. Metals have been made which approach the hardness of diamonds on the one extreme and the softness of butter on the other.

New metallic materials have also resulted from powder metallurgy techniques. In this process, different metallic materials are joined together under extreme pressures. Metallic elements have been joined by this process which under present alloying techniques are insoluble in each other. This process opens the door to an almost unlimited combination of properties and characteristics.

Recent innovations in metallic processes include: pneumatic forming, explosive forming, electric spark forming, electro-magnetic forming, plasma spraying, electro-discharge machining, electro-chemical machining, marforming, electron beam welding, continuous casting of steel, adhesive bonding, anodyzing, cold roll forming, shell stack molding and many more.

These are processes which at the present time have industrial importance. It is difficult to conceive of what the next few years might bring.

A realistic evaluation of some present industrial arts teaching might reveal that a better job is being done of teaching history than industrial arts. Only through a conscientious effort can industrial arts programs gain and maintain industrial representation. Constant revision and evaluation must be made of each instructional unit. "Yellow notes", or other notes which have served their purpose in days past, must be discarded and in their place must be inserted information reflective of the innovations of contemporary industry.

Maximum utilization is not being made by industrial arts educators of the means available to become cognizant of the innovations in industry. Too few industrial arts educators use such techniques as field trips, guest speakers with industrial backgrounds, audio-visual sources, industrial advisory councils, seminars, summer employment and correspondence with industry to gain an insight into and understanding of modern industry.

In summary, attention needs to be drawn to the objective of industrial arts which aims at giving an insight into and understanding of industry. This objective sets forth a major challenge. This task becomes increasingly more difficult as the innovations of modern industry are recognized. Failure to recognize these innovations will stymie the whole profession of industrial arts.

Dr. Hoover is Assistant Professor at Wisconsin State University, Platteville.

W-6.5 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN GRAPHIC ARTS
Chm., Earl E. Smith; Rec., John Gedker; Speakers, Robert A. Banzhaf, Ronald Sorensen, James E. Rice; Host, James F. Snyder.

TECHNICAL PHOTOGRAPHY IN INDUSTRIAL ARTS

Ronald Sorensen

To many educators, the present image of photography is probably that of a closet in an elementary school building which was converted into a darkroom to print yearbook pictures, or perhaps a high school club advised by an industrial arts, science or art teacher.

In some schools, however, photography has become a part of the curriculum. Most probably, it has been in graphic arts that photography has been included as a unit of instruction or was encountered by the student as he studied certain methods of copy and plate making. Some art teachers have also contributed to photographic "literacy" through its use as a medium for expression and development of concepts about elements of composition.

It may be observed that photographic instruction is commonly a means to the end of

visual communication, rather than as an end in itself. This is true of the technical photography program at Oswego, for although we are concerned with advancing knowledge about photographic systems, we are primarily seeking outcomes involving application of concepts as tools for the solution of problems within any functional area of industry. Applications directed toward art or audio-visual materials preparation are minimized because of previously existing photographic courses in those fields. However, very desirable diversification is effected by the many students who elect all of the photography courses that are available to them. Certainly such fragmentation would not typically be justifiable in the elementary or secondary school.

The technical photography survey course, initiated on a trial basis three years ago, was conceived and is developing upon the basis that photography is a means of extending the range of human observation by aiding the eye to sense events that would otherwise be lost as a result of man's perceptual limitations in time, illumination, distance and area, and his inability to store and retrieve information accurately.

Technical photography on the Oswego campus is classified as general education, and consequently may be taken by any student to fulfill part of the liberal arts elective credit requirement upon either the undergraduate or graduate level. Originally, all students were industrial arts majors who were primarily concentrating on graphic arts. Presently, graphic arts students are still in the majority, but increasing numbers of art, elementary and secondary education, English, math and science students (both men and women) are enrolling, and a few have transferred into the industrial arts program as a result.

Our general objectives are five-fold:

(1) To learn basic concepts of photographic technology by planning and experiencing laboratory methods.

(2) To acquire knowledge about the state of man's tools and techniques in photography which extend his perception.

(3) To investigate the feasibility of and design a study employing photographic technology as an analytic tool used in an area of industrial endeavor.

(4) To select and use photographic systems for the detection, recording and measurement of the subject phenomena.

(5) To analyze and interpret photographic data and attempt to derive a solution for the problem.

Instruction begins with a simplified concept of photography as employing sensitized negative and positive materials, The students progress with laboratory experiments which provide for directed discovery of ideas such as the factors influencing depth-of-field, lens aberrations, shutter distortions, equivalent exposure, material Reciprocity Law failure, and the generation of sensitometric data including D – Log E curves plus gamma and contrast index calculation. The course is culminated with an "original" investigation by each student. The following is a brief outline of course content:

I. Black and White Photographic Processes
   A. Silver halide
      1. Negative - Positive
      2. Reversal
      3. Sensitometry
   B. Non-silver Halide
      1. Diazonium and iron salts
      2. Electrophography
      3. Photothermography
      4. Thermography
II. Photo-optical Instrumentation
   A. Optics and Apparatus
      1. Light: natural and artificial
      2. Lenses and filters
      3. Camera bodies and shutters
   B. Methods Based upon Sensitizing Wavelength
      1. Infra-red
      2. Ultra-violet
      3. Radiography
   C. Methods Based upon Subject Speed
      1. Time-Lapse
      2. Speed and motion analysis

3. High speed
4. Open shutter and flash

D. Methods Based upon Subject Size
   1. Photomicrography
   2. Microphotography
   3. Macrophotography
   4. Photo copying and photo drawing
   5. Photogrammetry

III. Color Photographic Processes
   A. Negative - Positive
      1. Exposure and reciprocity
      2. Magnification
      3. Color balance
   B. Subtractive Reversal
      1. Film and paper
      2. Duplication

IV. Photographic Research and Experimentation
   A. Problem Background and Identification
   B. Photographic System Design and Application
   C. Derivation and Interpretation of Data

A photographic curriculum for the several levels of education is quite difficult to detail. Perhaps a personal view about photography in the school would be in order; it's a "tool," or as one photographic manufacturer puts it "— a way to do it better — and in some cases, the only way". Therefore, on the elementary and secondary levels, it seems more realistic for the teacher to employ photography within the existing curriculum where and whenever it's appropriate. An elementary class might make use of photography in conjunction with a field trip, or they might record the phototropic characteristics of plants.

Secondary school teachers have countless situations where photography can do the job better. With a photomicrograph of a specimen, the biology student is less likely to describe a paramecium as looking like his own eyelash. And a drawing student can diazo print a continuous tone pictorial without the loss of converting it into line copy. For graphic arts students, photography needs to be a unit of instruction since it's a graphic art method. Students who are taught process photography for offset lithography already have a good foundation. However, certain concepts will require treatment, for example, depth-of-field, exposure reciprocity and continuous tone reproduction, etc.

The scope of collegiate photographic instruction should become even wider, since it's concerned with both liberal and vocational education. A few programs have been established to prepare photographic engineers and technicians, professional and industrial photographers and cinematographers. But the relevance of photographic instruction toward elevating the general knowledge of professionals, from architects to zoologists, has not been recognized by educators. An appropriate place for this "awareness" to begin is within all the subject matter fields of industrial arts. But the final measure of success in creating understanding of photographic technology rests with graphic arts educators.

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W-6.6 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN DESIGN AND DRAFTING
Chm., Floyd Jack; Rec., Denton Floyd; Speakers, C. Dale Lemons, John Lavender, Harrison Goodall; Host, Leo D. Morgan.

LET'S LOOK AT INDUSTRY

Clifton Dale Lemons

The teaching of drafting or design/drafting has been a perplexing problem to industrial arts educators for many years. Evidence of this concern about the teaching of design/drafting is found in the profusion of research and literature available. The ACIATE Fifteenth Yearbook, Status of Research in Industrial Arts, reported eighteen studies conducted between 1961 and 1965.(1) Our professional journals consistently carry article after article about the teaching of drafting.

Typical of these is an article by A. G. Ochs in the September 1967 issue of School Shop titled "Modernize Mechanical Drawing." In this article, Mr. Ochs pointed out that "education for the future draftsman and designer must give great priority to the ability to design – and less to the ability to draw."(2)

This line of thinking is consistent with that of writers of articles in technical journals. The February 1968 issue of Engineering Graphics carried two articles concerned with improving drafting teacher skills.(3)(4) The concern of engineering graphics educators with the content of their courses prompted the publication of a special issue of The Journal of Engineering Graphics devoted entirely to the subject of design and graphics.(5)

The immediate impulse when approaching the topic of "New Concepts in Curriculum and Courses in Design and Drafting" is to look toward the emerging subject of Computer-Aided Design Technology. At the outset of this concept, it was rumored that within a few years the draftsman would be replaced by a machine. However, closer examination of the capabilities and functions of the computer reinforced the need for greater understanding of fundamentals of drawing. The effective and efficient use of computers in designing requires a knowledge of drawing and the design process. Much of the repetitive and laborious work of the draftsman can be replaced by the machine, but it will be years before the demand for designers and draftsmen will be diminished.(6)

As you may have noted, most of the more recent articles and discussions in drafting have been geared more toward a design orientation. The problem-solving method demanded in design has been shown to be more effective than rote exercises in promoting learning. John Rowlett's experiment with the direct-detailed method vs. the directed discovery method is evidence of this.(7)

The profusion of articles and research about relative developing technology and drafting educational theories seems only to entangle a teacher in alternatives. To wade out of this entanglement, let's look at industry. I do not mean to imply that industry is without problems in this matter, nor that industry is standing by with ready answers to our questions. But the source of our subject matter content is industry, and we should use this source whenever possible.

There are two studies presently in progress to determine technical competencies needed by draftsmen and designers. One such study is being conducted out of the Oak Ridge Associated Universities, Oak Ridge, Tennessee, for the purpose of establishing a technician training program. In this project, Donald P. Degli made a preliminary study of mechanical draftsmen to identify "the important elements around which an adequate program can be developed."(8) The results of this preliminary study proved the questionnaire method effective in obtaining the desired data. The results further revealed much information about drafting duties that would become meaningful only on close examination.

The other study referred to is one that I am presently conducting. The purpose of this study is to identify and quantify the technical competencies needed by teachers of certain vocational-technical subjects. One of these subjects is design/drafting. Although the study is directed toward vocational-technical education and is not completed, there have developed some implications for industrial arts. More specifically, implications for industrial arts design and drafting have become apparent.

A brief description of the procedures will show the factors germane to my topic, "Let's Look At Industry." In the first phase of the study, a task force consisting of six representatives from industry and three representatives from vocational schools was brought together in a workshop. These representatives were selected after being recommended by their company or school and after a personal interview. They represented a cross-section of industry. In all cases the individuals were outstanding, and most held supervisory classifications.

It was the responsibility of this task force to identify all competencies needed, used

or expected of draftsmen and designers in the composite of their companies. The workshop lasted for three days, during which a great amount of effort was expended. At the end of the workshop, a competencies listing existed in the form of notes and on tape that took several weeks to classify and organize into a questionnaire.

The relevant material for this presentation is based on the concepts resulting from that workshop. The defining of "drawing fundamentals" received much attention, as the fundamentals did not seem to be the same for all participants. Eventually they were agreed upon and included the following: (1) A knowledge of projection and all that it implies, (2) a knowledge of and ability to dimension, (3) ability to execute freehand sketches, (4) a knowledge of tolerances and tolerancing, and (5) a working knowledge of drafting standards, i.e., Military Standards.

An extensive list could be presented but these represent trend of thought. It is worth mentioning that exceptional skill in lettering was not of particular concern to this group.

Some other items that the task force felt were of great value to a draftsman or designer are: (1) That each person should have an appreciation for the role that his occupational classification plays in the whole of engineering services; (2) a general knowledge of materials and processes and the economics of industry; and (3) an ability to apply problem-solving techniques to the job at hand. Computer technology was of only mild concern.

I could continue at great lengths, but suffice it to say that from this workshop a questionnaire was developed that included 348 items.

I have since implemented much from this workshop into an existing course in machine drafting and design. This was done by dividing the class into design teams and selecting a design problem to be carried from analysis through completed working drawings. In one such class, a student who has been a design-draftsman for seventeen years with NASA and related civil services was enrolled. It was his expressed opinion that what we were doing in the course paralleled very closely the practices of industry.

I feel very strongly that it is time for industrial arts educators to get out of the textbook and the laboratory occasionally to examine what industry is doing. Not that significant changes are necessarily needed nor likely to result, but it only follows that we can better teach about industry if we expose ourselves to it more often. This discussion should not be misconstrued as implying that industrial arts should be the training of draftsmen. I am implying, however, that industrial arts education on the secondary level has a responsibility for providing the opportunity to youth to learn that which industry considers important; to develop correct concepts about the role of the engineer, the designer and the draftsman. This opportunity is not present in a course organized around the copying of drawings, drawing three views of a block and other similar traditional methods of teaching mechanical drawing.

FOOTNOTES

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W-6.7 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN ELECTRICITY/ELECTRONICS
Chm., Kenneth H. Bergman; Rec., Harvey Morgan; Speakers, Fred W. Culpepper, Rex Miller, Ernest B. Mayo, Richard Pierce; Host, John Ephraim.

INCREASE THE DEPTH IN ELECTRONICS FUNDAMENTALS

Richard L. Pierce

It is well known that thousands of new job descriptions in the electronics industry have appeared in the last ten years. The pace of change is likely to continue to increase. Many of these new activities have been learned on the job. It may not be as well known that those who adapted to change most successfully were those who were well versed in electronic fundamentals. It is human nature to give oneself most credit for newly gained knowledge, while forgetting the teachers who provided the fundamental understanding.

Industry continually presses educators, usually in specific terms: "We need technicians with more training in microwaves, or computers, or solid state speed controls, or numerical controls, or color TV, etc." The educator faces many restraints in attempting to meet these demands: it takes a larger budget for more equipment, better teach training, and perhaps most important of all, more time for teaching.

The most effective way to meet this increasing pressure is to improve the teaching of fundamentals, both in manual skills and in understanding electronic theory. In skills, the most important items include how to make good connections, how to use the volt-ohm-ammeter and how to use the oscilloscope with versatile sweep.

In teaching fundamentals, like other dynamic subjects in education, the tendency is just to grow and proliferate. Concentrated effort should be directed toward developing a clever, coordinated presentation of everything from Ohm's Law to the operation of common amplifiers, making the most effective use of the limited time available. Each time a fundamental concept is revealed to the student, it should be done in a way that makes the later re-appearance of that concept or principle in a complex circuit evident and familiar. If the volt-ampere relationships of resistors and other circuit elements are properly started, the task of applying understanding of linear and nonlinear current vs. voltage curves for brand new semiconductor devices becomes less frightening. Proper handling of the difficult subject of feedback, desirable in operational amplifiers and servo control systems but undesirable in certain amplifiers with high gains and stray coupling, can make later specialized training proceed more easily for both student and instructor. To accomplish these objectives often requires considerably more depth and breadth from the teacher of fundamentals than from those who follow with more specific and complex circuit applications.

As a concrete example: suppose we represent half-watt resistors on graphs as rectangles. The bottom horizontal edge lies on the voltage axis, the left vertical side along the current axis. The lower left corner coincides with the origin, a diagonal drawn to the opposite corner has a slope measured in amperes-per-volt or mho's of conductance. The reciprocal is the resistance, as is the ratio of the length of the voltage side to the current side. The area of the rectangle represents the power dissipated (or volt-ampere product). If a series of such rectangles is prepared to the same scale for the EIA resistor values of 1 kilohm, 1.2K, 1.8K, 2.2K, 2.7K, 3.3K, 4.7K, 5.6K, 6.8K, 8.2K and 10 K, the student's eye quickly spots the reason for the EIA value scale for 10% tolerance resistors. If all areas correspond to 1/2-watt, and all lower left corners coincide, the locus of the opposite corners is a hyperbola. This constant-power locus is a familiar line on vacuum tube anode characteristics and collector-emitter transistor curves. When the time comes to study these non-linear curves, the student can think of them in terms of resistor rectangles, if it helps his understanding. Technicians often have to combine EIA resistor values to make some other value, or to meet a power dissipation requirement. In the latter case, the total circuit power can be a large room-sized rectangle of width total

voltage and height total current. By taking resistor rectangles and moving them around until the room is filled, the technician can synthesize series, parallel, or series-parallel networks readily, without exceeding the power rating of some resistor. This concept has been carried far enough so that most electronics instructors can pick up the ball and run.

Another very helpful graphic technique shows the transfer function, that is, output on the vertical axis and input on the horizontal axis. In brief, by taking a simple differential amplifier circuit, and changing the common emitter resistance from a high to a low value, and by the judicious use of regenerative and negative feedback resistors, it is possible to take the student from a simple amplifier through wide-gain, high-fidelity, to Schmitt trigger, operational amplifier, and finally logic gate and flip-flop. The transfer characteristics for each are shown with the graph of volts out per unit volts in, and the job of showing how negative feedback reduces gain, certain combinations produce hysteresis, and why certain circuits have high gain but poor noise immunity, while others have excellent noise characteristics but low sensitivity can be easily shown.

If instructors at the high-school and technical school level would concentrate on fundamentals, and condense the method of covering the material, they would indeed be providing the industrial employer with a very high-potential technician employee – able to learn new things on the job with excellent grounding in fundamentals.

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W-6.8 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN POWER AND MECHANICS
Chm., Marlin Meyer; Rec., Karl J. Windberg; Speakers, Angus MacDonald, Fred McGilvrey; Host, Dmitri Slobodian.

IMPLICATIONS FOR POWER MECHANICS IN JUNIOR HIGH SCHOOLS

Angus J. Mac Donald

Power mechanics is a relatively new area being introduced into many junior high school industrial arts programs. At this early stage of its development, it is very difficult to identify it as a specific body of knowledge through an investigation of the present offerings which are so diverse. About the only generally common elements found in the various junior high school power mechanics offerings are its name, "power", and "energy". It is probably healthy for an emerging area such as power mechanics to be in such a state of dissimilarity and flux. A wide variety of programs is an excellent source from which the final strong programs will be able to evolve.

Starting with the rather widely accepted premise that industrial arts on the junior high school level should be more or less introductory and exploratory, many curricular implications involving power mechanics are in the offing. These implications will, for the most part, involve the scope and sequence of the concepts to be presented to the student, as well as the types of activities in which he will be able to participate in order to reinforce the concepts. Ancillary implications will involve software such as books, audio-visual aids, booklets, pamphlets and the like. Ancillary implications relating to hardware for the activity phase of the program will involve equipment, material and facilities.

From the vast body of knowledge available for power mechanics curricula, what scope and sequence of knowledge would be appropriate for junior high school students? It is easier to ask this question than to answer it. Some general criteria for content in a junior high school power mechanics program could be applied to an arbitrary construct of power concepts, in order to glean some guidelines for developing power mechanics curricula for the junior high school.

Possibly one criterion which could be applied to the power construct is one which maintains that the level of abstraction at the junior high school should be kept low, but not eliminated. It should be kept low because of the mental immaturity of the average student whose previous educational experiences have, for the most part, been a direct experiencing of see, touch, hear, do, etc., as he was being slowly introduced to the abstractions of language, mathematics and some science. Abstraction should not be eliminated because it is an integral part of learning; it should be introduced at a number of levels commensurate with the divergent abilities of the students.

Textual content should cover subject matter which is either readily observable or can be effectively explained through the utilization of many pictures, other audio-visual aids or demonstrations. Concepts which require basic scientific knowledge to which the student has not been previously exposed should be avoided, or the necessary basic science should be taught along with the power concepts. The emphasis should be on total understanding so that subsequent power concepts which build on previous ones can be readily understood.

In the area of student activity, abstraction should be kept at a level wherein the student knows what he is doing, why he is doing it, and what is the importance of his experimentation. Rote or slavish direction obedience is not experimentation or problem-solving. Activity should progress from a directive experimentation, for an understanding of the concept, to free experimentation and problem-solving on the part of the student, for reinforcement of the concept. Experimentation should be leveled to a wide range of student abilities. More obvious abstractions involving practical or empirical problem-solving experimentation should be available for the lower ability students. The higher ability students should be given more subtle abstractions involving mathematical and reasoning solutions of problems, and experimentation to confirm their mathematical computations or test the validity of their reasoning. Thus, the students are being groomed for later programs involving, of necessity, high levels of abstraction which cannot be readily demonstrated, i.e., atomic theory, electrical theory and the like.

Another general criterion which could be applied to the power construct is one involving student interest and motivation, which are so essential at the junior high school learning level where student maturity is only able to ascertain some short-term goals for learning. Power concepts which are pertinent to his usual activities and within his immediate experience should be utilized in such a way that they lead to an understanding of other power concepts more remote from his present well-being. The transition from the immediate to the remote is feasible as long as concepts are taught along lines of basic scientific principles identifiable as common to both the immediate and the remote.

Student activities should also be geared to student interest and motivation. These activities in a junior high school program of power mechanics would probably fall between the sterile science laboratory approach and the usual industrial arts project-centered approach. They might closely approximate some of the applied science activities which some general science programs utilize. These activities are usually student-conducted experiments demonstrating applied science principles with rather specialized laboratory equipment. In power mechanics, the same activity could take place, except that the students would utilize adapted industrial equipment. They would experiment with the applied science concepts on a more industrially oriented basis so that the activity would take on a more interesting air of reality. From such activities, they would also gain certain knowledge and skills relative to working with industrial equipment – a traditionally sacred "must" for many industrial arts teachers.

A final implication is based on the criterion that junior high school students are usually very volatile and active. It involves the choice of curricula from the construct which allows the students a wide latitude of learning beyond the normal classroom curricula and laboratory activity, but well within their varying abilities. Power concepts which underlie common knowledge area should be selected in preference to concepts which are rarely utilized in everyday living, or are so abstruse that they are discussed only in highly technical publications.

In the same vein, student activities should be planned with plenty of student involvement, as well as being open-ended, so that the student has plenty of opportunities to venture out on his own and to discover for himself the wide latitude of applications to which basic science principles lend themselves.

Power mechanics curriculum content must be designed to fit the junior high school student, not the student to the curriculum.

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IMPROVING EDUCATION IN WOODWORKING

C. Austin Eckerline

Did you read the paper this morning? If so, did you see the announcement by the DuPont Company of a revolutionary new plastic? It sounds like a truly remarkable discovery according to the newspaper report, but we have become so accustomed to new technological advances that you may have overlooked it.

According to the paper it is beautiful, relatively cheap, and available in a wide choice of weight, strength, color and texture values. Machining characteristics are excellent; it can be bent, sliced, planed, sawed and sanded. It can be glued, nailed or screwed to itself, other plastics, paper or metals. It can be finished naturally or painted to match any decor. Sounds like a real discovery, don't you agree? I have misled you, DuPont did not develop such a material. Even with their enormous staff, facilities and budget, I doubt that they could produce such a universal plastic, and there's really no reason for them to try. God has already given us such a product. It's nature's own plastic, wood. Maybe you've never considered wood a plastic, but it is. Today, I invite you to think of wood as the truly remarkable creation of nature that it is, and together let us explore it during the next few minutes.

Most of us take wood too much for granted; this is a mistake, especially for you who are teaching our young people how to work with it and produce useful products for home and industry. Being a wood technologist, I have a better understanding of what it is, how it behaves, and why it is often so contrary. I want you to learn more of this marvelous material, too.

Last summer I was invited by Dr. Jack Luy of Eastern Kentucky University to instruct at an eight-week summer institute in wood technology for high school industrial arts woodworking teachers, funded by the National Defense Education Act. There were 25 students from all sections of the nation present. In preparing to teach these men, I became aware that there is a wide gulf between the wood technologist and the industrial arts woodworking teacher. Little or nothing has been done in the past to acquaint these teachers with a basic understanding of wood as a structural material. Many of you teach carpentry and the uses of wood in construction, but we will confine this discussion to woodworking instruction as it applies to the production of furniture, fixtures, flooring and millwork.

Wood-based industry is in a period of rapid transition, with new machines, new methods and new products being introduced almost daily.

Woodworking has traditionally been a craft industry employing much hand labor to produce a quality product. The old ways just won't work in today's labor markets. Today's industry needs highly-trained, eager young people who can meet the challenge of the future. Besides the lack of communication between the wood specialist and the woodworking teacher, there also seems to be a lack of rapport between the teacher and the industry. This is equally unfortunate for the teacher, the student and the industry. Teachers are missing a chance to get valuable program support, students are missing an opportunity to enter a rapidly expanding field of work, and industry is missing a chance to hire the type of young man that they desperately need now, and in the future. Management, because of competitive pressures, often doesn't take the initiative, so if the job is to be done, it will have to be the teacher who does it. Therefore, I invite you teachers to help bridge this gap.

In the past, the woodworking industry has imported its skilled labor from Canada or Europe. This was the easiest and cheapest way to hire the necessary hand skills that companies required. This source of labor has largely dried up for a number of reasons;

mainly the amazing economic recovery of Europe due to the Marshall Plan and the Common Market. Also, industry's emphasis has shifted from the skilled hand craftsman to the highly skilled machine setup man and operator. Industry just can't afford hand labor at today's labor prices. Besides, machinery is now available to do the job faster, more accurately and better than the old way. This equipment, of course, requires a different type of skilled employee. And since we can't import him, we must train him. You can do this, if you meet this challenge and seize this opportunity. Just as the old ideas won't work in industry, the old ideas of education won't work, either.

Therefore, today I wish to outline the changes that I believe are required if the high schools are to supply this need. These conclusions were not reached in haste, but from my experience of 17 years as a manager of woodworking plants and 4 years in education. My present job is primarily to bridge the gap between the school and the shop. It's a big job, but it is also fun, and I enjoy it. I believe you will, too.

To tackle this problem will require an open mind. Some of the ideas I'm going to suggest may shock you, and some may make you angry. In any case, I hope they will stimulate your thinking. If I can do this, my trip here will have been worthwhile. Here is my 15-point program for teaching students the skills that are salable in today's marketplace. Anything less is shortchanging the student and the taxpayer, not to mention the industry.

(1) The first priority of my program is the retraining of present woodworking teachers in basic wood technology and requiring such courses for future teachers in this field. You can't teach woodworking if you don't understand wood. Colleges and universities that train teachers must require this instruction for present student teachers and they must also offer it to experienced teachers through evening and summer courses. This education should start at the beginning with tree and wood identification. Thus I'm suggesting dendrology (tree identification) as the logical place to start, with courses in wood identification to follow. These courses should stress the differences of basic structure between the softwoods and hardwoods. The presence of resin canals, small rays, long wood cells and the absence of large pores distinguish the softwoods; thicker cell walls, heavy rays and large pores distinguish the hardwoods. Such knowledge is basic to anyone who wants to understand wood. The properties of wood also should be explored, with emphasis on wood moisture relationships, for this explains many mysteries of wood behavior. Wood shrinks ten times as much across the grain as along it, and twice as much in a tangential or flat-sawn plane as in a radial or quarter-sawn plane. An understanding of the alignment of the wood rays and pits in the cell walls explains why this is so. The instruction must also include information about both air and kiln drying, what moisture content is, and how it is determined. It is the weight of the water in the wood expressed as a percentage of the weight of the bone dry wood substance. Fiber saturation point should be explained and understood, for this is the point at which the cell cavities are empty of water and water begins to leave the cell walls. This loss of water in the walls causes lumber shrinkage and brings the problems associated with it. Finally the course should cover wood behavior. It should explain why hickory is tough and strong, while white pine is soft and relatively weak. Definitions of tensile strength, bending strength, stiffness and modulus of elasticity should all be explored and explained. Lumber grading should be covered in some detail too, so that you understand why hardwoods are graded on the number and size of clear pieces that can be cut from the board, while softwoods are graded by defects in the whole board. Hardwood boards are cut up and used, while softwoods are used as they are received. You don't cut out the knots in a 2 x 4 before you use it.

Wood sandwich products should be explored in detail, too. Plywood, both lumber and veneer core, laminated beams and finger jointed products should be studied with emphasis on the adhesives, the equipment and the manufacturing techniques used. Finally, the course should cover modified wood products such as particleboard and hardboard. It should explain how chips or flakes are cemented together to produce particleboard, while hardboard is made by cementing individual wood fibers together, as in paper manufacturing. In short, you as a teacher need a course in wood: the different kinds, where they come from, their structure and properties, how they behave and how we can modify wood into other usable products.

(2) Teachers should get some industry experience during summers both while in school and while employed in teaching. Industry today has equipment that you've never seen and perhaps never dreamed of. But you should be aware of this equipment, and how it fits into the production process. Today we have machines that can sand plywood with 1/85 in. faces at a speed of 500 sq. ft. per minute; that can glue up 3/4 in. panels at 20 sq.ft. per

minute; that can rout by tracing a blueprint or from information fed to the machine by magnetic tape; that can plane wood with abrasive belts instead of using cutter heads; and that can sand solid panels at speeds of 150 lineal feet/minute. These are but a few of the machines industry uses today. We also have new adhesives like the epoxies and hot melts, new finishes like the ureas, vinyls, polyesters and urethanes, and wood substitutes such as plastic mouldings and vinyl overlays. Printing, embossing and other techniques permit us to make cheap woods such as poplar and gum look like expensive oak, maple, walnut and mahogany.

(3) You should read trade magazines regularly and make such reading available to your students. The three best are Woodworking Digest, Wood and Wood Products and Industrial Woodworking. Read at least one. There is also a regular list of additional information available in each magazine issue by writing to equipment manufacturers, trade associations and universities. Obtain these giveaways and pass along the best ideas to your students.

(4) You should make it your business to know local industry leaders, their companies and products. They are the employers who will hire your students and perhaps you, too, to get the summer experience that I suggested. You should also call upon them to talk to students and provide the expertise in special areas of instruction. They also can supply local citizen support to purchase needed equipment and facilities. They might even donate machines for a specific training need. Get to know these people and you'll find you have friends who are happy to help you. Also become acquainted with labor leaders, for they can boost your program too.

(5) You should consider leasing instead of purchasing equipment, with the option to update when newer and better machines come on the market. It may even save the school money and certainly offers you greater flexibility in the choice of machinery. It also softens the shock of the large initial purchase request.

(6) You should make greater use of out-of-school teaching talent. Invite equipment people in to talk about machinery, and material suppliers such as lumber, adhesive and finishing sales people to explain their products. They have movies and filmstrips available for just such purposes, and such people are experts in their fields.

(7) Make greater use of your state university or nearest forestry school for guest lecturers and extension specialists. Use their film libraries where you can. Most states have people available for special instruction and are delighted to visit high schools. Invite them.

(8) Make greater use throughout your teaching of films, filmstrips and perhaps programmed teaching. The National Forest Products Association in Washington has a complete catalog of literature and films available free upon request. This Association also has technical people who are pleased to visit your class and talk to students about wood.

(9) Get over the "hand tool and home workshop" mentality. You must realize that industry uses heavy specialized equipment to produce efficiently. Light equipment is fine to learn on, but be sure the students understand that this is only for learning. Develop simple projects where several students set up a simulated production line and each does a single operation to produce the final product. This is particularly good toward the end of a woodworking course for a project so that the student can become more industry-oriented. It also illustrates how a long product run justifies the time and expense of a jig or fixture to make an operation safer, faster and more efficient.

(10) Use field trips to acquaint students with local industry. Most companies welcome visitors, particularly from schools. They are also selfish and would like to be able to hire good young workers. Don't let a field trip become a mob scene. Schedule two or three boys at a time for an "in-depth" look at the business and perhaps lunch with foremen and managers. This takes more effort, but provides a much more meaningful experience for the boys. Require a short report from the student after the trip about his experiences, to stimulate greater interest and questions during the tour.

(11) Make use of displays of local products, safety posters and exhibits to show the range of items manufactured from wood. St. Regis Paper Company in New York City has a whole series of color ads on wood that should be in every high school woodworking shop. And they are free for the cost of a letter to the company. Get them for your shop.

(12) Plan to take some new courses at regular intervals to learn more about the latest teaching techniques. These can keep your outlook current and may also put money in your pocket, if the principal is aware of your studies.

(13) Acquire some basic understanding of the computer, what it can do, and what it can't do. Most people are frightened by these machines. Remember computers are only

as smart as the programmer. Here again get your local IBM or Univac salesmen to talk to your class in this specialized area. Computers are being used in woodworking more and more. First they were used only for payrolls and billing; later for inventory control. Now we are beginning to use them to figure lumber yield, to set work standards and machine loading times. They have even been used to operate certain machines, and this use will certainly increase as even more sophisticated computers and optical scanners are developed.

(14) Investigate work-study programs for some of your students so they can work as well as go to school. This may be especially helpful to students from low income groups by supplying some extra family income while they continue school, and make the daily instruction much more meaningful, too. I believe that many students who presently drop out and become a problem to society could be salvaged by such courses. Let's try to make them useful citizens instead of dropouts. Investigation may turn up some federal or state money for such a project.

(15) Finally, I invite you to bring more enthusiasm to the classroom or shop. Wood is the most exciting material in the world, if you understand it. Become better acquainted with it, know where the tree grew and acquire some understanding of logging and sawmilling. You can't be enthusiastic about something you don't know or understand. Enthusiasm for your subject can go a long way toward making up for deficiencies in equipment or teaching techniques. Enthusiasm is contagious. If you're enthusiastic about your subject, your students will be, too. Wood can be a very dull subject, or it can be very exciting. The choice is yours. If the woodworking industry is to prosper and grow, it must have a continuing supply of properly trained and motivated young people eager and willing to accept the challenge. As woodworking teachers you have a responsibility to instruct and stimulate these young people. I hope I have given you some ideas about ways to do it better.

Mr. Eckerline is Wood Consultant in the Department of Forestry at the University of Kentucky, Lexington.

W-6.10 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN PLASTICS
Chm., Loie Grandprey; Rec., Clark A. Malcomson; Speakers, James Runnalls, Gerald L. Steele, Richard Reynolds; Host, Stanley Turner.

NDEA PLASTICS INSTITUTE: A FOLLOW-UP

James J. Runnalls

Title XI of the National Defense Education Act was extended in November, 1965, to include in its institute program teachers and supervisors of industrial arts. Five institutes were set up for the summer of 1966 and provided advanced study opportunities for 144 participants. For the summer of 1967, the number of institutes was extended to twenty-nine.

Stout State University was awarded one of the 1967 institute contracts for a technical specialty in industrial arts plastics. The purpose of this paper, then, is to show the degree of success of the institute in encouraging the participants to initiate and include instructional units about plastics in their teaching.

The very high level of interest in industrial arts institutes was illustrated by the over 1,100 inquiries received by the plastics department at Stout. Twenty-five participants were selected from a total of 689 applicants. The participants represented 19 states and one trust territory of the US.

The participants were selected with the assumption that they had had no prior experience in working with plastics, nor had taken any formal college courses in industrial arts plastics. Each applicant was to have indicated that he was not teaching any classes in

plastics. It was discovered after the participants arrived on campus that two of them were actively engaged in teaching comprehensive units in plastics, but that they did lack formal plastics training in an industrial arts classroom.

The content of this institute was divided into four major areas of instruction: plastics materials and processes, tool making for plastics, educational media and a seminar.

In the plastics materials and processes section, the participants of the institute were provided with an opportunity to have laboratory experiences in most of the plastics processes. The tool-making for plastics dealt with the production of steel tooling for plastics processing. The participants studied about the theory of mold making and each participant completed a steel compression mold. The educational media section provided the participants with an opportunity to produce overhead transparencies, 35mm colored slides, and an instructional film, all pertaining to plastics processing. The seminar was used to develop courses of study to be used in teaching plastics at the junior and senior high school level.

All of this instruction was supplemented with field trips to plastics processing plants, to an extruder manufacturing plant and to a tool shop of a plastics processing corporation.

It was decided toward the end of the institute that several follow-up studies should be made to ascertain the effectiveness of the institute in assisting the participants to initiate plastics programs within their schools. It was decided that the first follow-up should be conducted toward the end of the first school year after the institute.

One of the questions on the application to the institute pertained to the desires of the applicant to set up or initiate a plastics program. Each of the participants expressed a strong desire to learn about plastics and a desire to set up a program in plastics when he returned to his school. Each of the applicant's immediate school supervisors, in many cases superintendents, indicated that he would be willing to support the applicant in initiating a new program in plastics.

A follow-up information form was sent out to each of the participants in the latter part of March. The following data were collected from the information forms sent out:

Each of the participants indicated that he had gained enough knowledge about plastics from the institute to teach a unit or course in plastics.

One of the participants indicated that his full-time teaching assignment was teaching plastics. Four others indicated that part of their teaching assignment included classes in plastics. The major teaching assignments of the others included; seven teaching general shop, five teaching metals shops, seven teaching woodworking and one teaching auto mechanics. The auto mechanics instructor was the only one who indicated that he was changing schools next year. His full-time teaching assignment will be in setting up and initiating a new plastics program. Nine, or 36.0 percent, of the participants were not teaching any units about plastics in their laboratories.

It was noted that eleven of the participants were able to purchase plastics processing equipment as a result of attending the institute. However, eight of the participants were unable to obtain equipment either because their administration would not let them set up a new program or because the school boards would not provide funds.

To learn what communication had transpired between the participants and their respective school boards, the information form showed that 12, or 48.0 percent, of the participants had reported to their school boards on their attendance at the institute. Five of these participants were among those who were not teaching any units about plastics, and two of the five were not receiving any support in initiating a plastics program.

The information form revealed that the participants were kept busy during the school year informing groups about their participation in the institute. Seventeen, or 68.0 percent, of the group gave reports or demonstrations to local or state industrial arts associations during the school year. Three of the participants are on an AIAA panel discussion on plastics at this convention.

It would appear that the participants are not aware of the funds available to industrial arts under Title III of NDEA, or else allocations have not been made by their respective states or schools. Only one participant indicated that he was using matching funds of Title III to purchase plastics processing equipment for next year. Thirteen, or 52.0 percent, of the participants were allocating specific funds to purchase plastics equipment for next year. The range of funds was from $320 to $10,000, and the mean was $3,227.

During this first year it could be naturally assumed that the participants would be lacking processing equipment since the equipment would have to have been ordered, in most cases, before they attended the institute. One participant reported that he had been able to procure a thermoforming press, compression press, two injection presses, a

rotational casting machine and plastics welder this year. Three others reported having thermoforming presses, and two others had injection presses. It is assumed that those individuals working with vinyl dispersions also had access to heating equipment.

The participants who were teaching courses or units in plastics did obtain plastic materials to work with, even though not all of them had processing equipment. The most common material being used was polyester resin for hand lay-up of projects. This was being used by twelve, or 48.0 percent, of the participants. Nine were making use of vinyl dispersions and six were using urethane foams, expandable polystyrene and polystyrene sheet material. The acrylics were being used by nine of the participants even though little, if any, emphasis was placed on the use of this material during the institute.

During the seminar of the institute the participants were encouraged to subscribe to plastics periodicals to keep abreast of developments in the plastics industry. Eleven of the participants have subscribed to Modern Plastics magazine; thirteen did not subscribe to any plastics periodicals. Seven, or 28.0 percent, of the group requisitioned plastics books through their school libraries.

All of the participants have made molds of some type during the school year. This would seem to indicate that they did have a continuing desire to work with the medium of plastics.

During the seminar session of the institute, six courses of study for plastics were developed. These courses of study were designed to meet the specific needs of certain grade levels, laboratory facilities and time available to teach about plastics. Eleven of the participants were using the courses of study which they helped to develop, and the other five were using one of the other courses of study developed by the group.

It seems safe to assume at this time that the Institute in Plastics was a success, since it is known that at least 16 of the participants were teaching a course or instructional unit about plastics. Any program which provides a summer income can appear attractive, but to learn at the same time is indeed a worthwhile proposition. It is interesting to note that five of the men applied for NDEA Institutes again this year, but all felt that they would not be chosen because of prior experience at an institute.

Dr. Runnalls is Associate Professor at Stout State University, Menomonie, Wisconsin.

PLASTICS AS AN INSTRUCTIONAL AREA

Gerald L. Steele

In an age when the size of the world is shrinking, people are moving about with ever-increasing ease, new technology is being created daily and man is looking towards the heavens, it is necessary for the curriculum of the schools to keep current with new technological advances.

One area of the new technology which has had little emphasis in the schools until very recently is that of plastics or synthetics. Even the recent emphasis has been less than desirable. It is this area of technology to which I address myself today.

Some idea of the importance of the plastics industry can be established by a recent estimate of the potential of this industry. The Society of the Plastics Industry, Inc., has recently stated that the industry presently has reached about 4% to 5% of its total potential. It has a growth rate of up to five times that of all other industries. It is expected to be one of the major employers in this country in the near future. If these facts are true, and all indications are that they are, vast new horizons are still to be blazed by this relatively new family of materials.

Let us look for a moment at what these new materials are. Plastics have been defined by Swanson as "those materials which are synthetic, or man made, which have large molecules (high molecular weight) and are moldable during manufacture, but eventually harden." These materials can further be broken down into two general categories: thermoplastic and thermosetting.

Thermoplastics are those synthetic materials which are moldable when hot and rigid or semi-rigid when cooled. They may be remolded with subsequent heating. Thermo-

setting plastics are those which are moldable under heat and/or pressure and cure to a solid part. Thermosetting plastics may not be remolded; they are permanently cured.

These two types of plastics have many generic kinds within each family. Generic names such as acrylic, nylon, cellulose acetate, polyethylene, phenolic and melamine should be familiar even to the casual observer.

What does this all have to do with industrial arts, we ask? It becomes increasingly obvious as we walk through the local drug store, the hardware store, the super-market and the clothing store, to name a few, that plastics are becoming increasingly important in our lives. If we are to depend upon plastics and intelligently use plastics, either as producers or consumers, we ought to know more about them, how they are produced and how they are processed. Since industrial arts has been the subject area which has been made up of other industrial materials, then why not plastics?

Well, what has been done with plastics in industrial arts in the past? Pitifully little, if we are to use "Interpretation of Industry" as one of the cornerstones or objectives for industrial arts. Most of the courses or units in plastics at the secondary school level have been based upon secondary finishing operations of acrylic plastic sheet, the so-called "fluffing and buffing of acrylics".

Just how little has been done at the college level is reflected in James Runnalls' doctoral thesis of 1965. His study of over 200 college industrial arts departments in the US has shown conclusively that the colleges have only very recently begun to teach the concepts of the plastics industry.

If we are truly to attempt to interpret the plastics industry, we must teach the concepts of that industry and not "fluffing and buffing" of acrylic, a skill which cannot be defended as an industrial or mass production process. It can only be described as a minor finishing operation or craft approach to plastics.

We ask, then, what are the concepts of the plastics industry which should be taught? If we use the volume of plastics materials processed as a criterion for selection of the most important plastics process, we would arrive at injection molding as being the most important to the industry. This process converts the largest tonnage of plastics materials into consumer products of any process. Therefore, my first recommendation is that a course or unit in plastics at any level must include injection molding.

The second most important process now seems to be thermoforming, i.e., vacuum forming, blow forming or mechanical stretch forming. These three thermoforming operations, with all their variations and combinations, probably account for the next largest total volume of plastics materials processed into finished consumer products.

The third process in terms of current importance to the industry is the oldest, compression molding, which, with slight variation, becomes transfer molding. Although widely used, it is a more costly process than injection molding, and in many cases is being superseded by injection molding wherever specifications and end use will permit.

A number of other processes remain, many of which can be successfully practiced in industrial arts. A bare minimum plastics program at the secondary level should include no less than the three processes I have just described, namely, injection, thermoforming and compression/transfer molding.

Many will argue that extrusion may be more important than compression/transfer or thermoforming in terms of pounds of plastics processed. In these terms they may be right, but when we analyze further we find that much of the extruded volume is sheet and film which is subsequently thermoformed into end products. Nevertheless, it is important and should be included in a sound program.

Blow molding is another process which is becoming increasingly important. One only has to look on the grocers' shelves to find evidence of this in containers for liquid detergents, shampoos and similar items. It is rapidly gaining in volume.

Rotational molding has gained a nice share of the market recently and has become feasible for industrial arts. It promises to gain in popularity rapidly.

Other processes or materials which have proved themselves and deserve to be included in a plastics course are reinforced plastics, fluidized bed coating, foam molding, welding and heat sealing, vinyl dispersion coating and dip coating.

Each of the processes mentioned is feasible for industrial arts although some are more costly than others.

Of course, one cannot talk about curriculum without being caught up in the equipment question. But for the moment, I prefer to discuss the curriculum aspect a bit further. I would like to pursue the idea of what material should be taught in what order, and to what depth it should be pursued.

The question is simply this, how much can we include in a beginning course? The introductory course should include a bit of the history (just a few of the high points to give some background), classification of materials (thermoplastic and thermosetting), familiarity with the common generic materials and, finally, familiarization with the processes, including the actual operation of the associated machines.

In order to become thoroughly familiar with the industry, one must become involved in the design of products and the design and construction of molds. This content should be contained in the second course, together with a deeper look at basic polymer chemistry.

A third course might indicate advanced design and mold construction problems developed around an independent study scheme. Problems may also be developed in the area of plastics materials testing.

One must be reminded that the above three courses are recommended for undergraduate college curriculum on the quarter system. Should they be applied to the semester system at the college level, some adjustments might be in order, such as combining the three courses into two. Consideration should also be given to undergraduate and graduate problems courses in plastics where the student and the instructor develop the problem in cooperation, based on the background of the student.

Knowing full well that many students taking a plastics course at the graduate level have not had adequate background to pursue such work on a problem basis, I suggest that adequate background be developed in such a course. This should be done at an accelerated rate during the first part of the course, to be followed by a problem-solving approach to the subject at hand.

The problem of specifying equipment is always with us. Equipment must match the curriculum in order to satisfy the objectives of any course. So let us look at some of the objectives I would hope to satisfy in a series of plastics courses at the undergraduate level.

In addition to all of the noble objectives such as knowledge of the history of the industry, appreciation for its importance, knowledge of the classifications, types and kinds of plastics, knowledge of and ability to use the various processes, design, safety and interest in plastics, there is one which I think is of utmost importance. We are in the business of preparing teachers who will instruct our children. These teachers will in all probability specify the equipment that they will need for their courses. It seems of paramount importance that we instruct them on how properly to specify equipment for those courses. Since the level of instruction (grade level) should have a direct effect on the equipment specified, we should provide equipment for different levels of instruction at the college level, allowing the students to become familiar with all of it.

There is now available plastics equipment suitable for industrial arts use for junior high, senior high – general and senior high – post-high-school vocational levels of instruction. Such varieties of equipment for the various levels of instruction should be available for the students to learn to operate when in college.

The problem that I foresee is that at the college level large pieces of expensive equipment will be purchased, and the graduating student will only be able to operate this large equipment. Further, he will know about this type only, which often results in his not being able to select equipment which the students at his level of instruction will be able to operate successfully.

If, on the other hand, various levels of equipment are available, the college student learns how to operate each according to its purpose, he is in a better position to select equipment and teach the course, and, knowing this, he will be encouraged to set up new courses in this area. Teachers tend to teach what they know best. Teachers shy away from the unknown. Many do not care to experiment. We in teacher education can reduce this tendency by providing the necessary experience and knowledge in our courses.

Advanced courses in plastics should provide the student with knowledge and experience in the design of plastics products, together with design and construction of molds associated with that product. They should expand the student's knowledge of plastics materials and their proper applications. A good product requires a good mold.

Mold-making techniques are necessary, because very few equipment manufacturers provide or sell molds for their equipment. Those molds that are available are prohibitive in price. So in order to use the equipment, the instructor finds it necessary to develop his own molds.

Mold-making is an art which can only be learned through practice. It seems that the more problems the student encounters, the more he learns. The general principles of mold design and construction can be provided for the student, but it is only after he has

had the trial and error experience of mold design and construction that he truly understands the process. At this point, he begins to become qualified to teach plastics at the secondary level.

Further experience in plastics should include total design of products where more than one material or plastic process (or both) are included in one product. Different parts of the product should be fabricated or molded from different plastics materials by a variety of processes. Where possible other materials, such as wood, metal, glass, etc., should be incorporated into the product.

New frontiers should be explored by the advanced student or graduate student. He should make new applications of existing processes or adapt processes to industrial arts where they do not now exist.

To sum up my remarks, I feel that we need to develop total programs in plastics for industrial arts teacher education so that the graduating student is fully prepared for developing and carrying forth a solid secondary school plastics program. He must know the background of the industry, its growth and potential, the classifications of plastics, the popular plastics materials and their end uses, the processes of the plastics industry and their proper use and how to design, develop and construct molds for plastics products. The student should also be able to specify and defend the justification of plastics equipment for educational use.

This all sounds like a large order, but it is no more than we ask of a woods, metals, electricity, power mechanics, graphic arts or drafting instructor. It cannot be done in one three-quarter-hour college course. We do not do it for the above areas in that time; we should not in plastics. An area as important as plastics is becoming deserves a lot more emphasis than it has been getting even in the past two or three years. More and more colleges are looking for plastics instructors. This is a good sign. At least they are becoming aware of the problem.

My remarks have been aimed at the context or framework or structure currently associated with industrial education. The new approaches such as the Ohio State-University of Illinois Industrial Arts Curriculum Project, the Stout American Industries Project, Don Maley's methods and others require the materials and processes of the plastics industry as much as, if not more than, our current pattern of teaching industrial education. Some modification of course structure may be in order for the new approaches but I feel that the same objectives must be satisfied.

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W-6.11 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES IN AEROSPACE EDUCATION
Chm., John Kerr; Rec., Charles Swinford; Speaker, Peder A. Otterson; Host, Robert Spinti.

MANPOWER REQUIREMENTS FOR THE AEROSPACE INDUSTRIES

Peder A. Otterson

Aerospace Industry

The descriptive term "aerospace" is relatively new to our vocabulary. It implies an extension of man's aeronautical activities within the atmosphere to the space beyond. The Aerospace industry can be considered to include the research, development, design and production of all aircraft, missiles and space craft and their supporting equipment. This would include manufacturing plants that make complete aircraft or aerospace vehicles as well as those making component parts or sub-assemblies for these vehicles.

Federal government agencies such as the National Aeronautics and Space Administration and the Department of Defense, as well as private and university research labora-

tories engaged in aerospace work, are generally included as part of the aerospace industry.

In 1966, over 1.3 million people were employed in the aerospace industry. About a half million workers were employed in the production of aircraft, another half million were engaged in the construction of missiles and space craft, and an additional 150,000 workers were helping to develop and produce the complex electronic equipment needed for today's aerospace vehicles. Civilian employees of the federal government comprise the remaining aerospace workers.

Aircraft are produced to transport goods and people to all parts of the earth. About three-fourths of aircraft production in dollar value is manufactured for the armed services. Military aircraft include bombers, cargo planes, fighters, trainers and helicopters. More civilian than military planes are produced each year. Civilian planes vary in size from huge jet airliners costing millions of dollars to small single-engine planes with a price of little more than a deluxe automobile. A recent survey indicates that the scheduled air carriers have currently on order aircraft valued at 5.5 billion dollars to be delivered through 1971.

In the last few years, there has been a pronounced growth in the number of aircraft produced for private business and pleasure flying. Space craft are designed to be launched to escape the earth's atmosphere by means of speed many times that of sound. Rockets are used as their propulsion systems, because such engines are the most powerful and can operate without an air intake. A variety of different kinds of space craft is needed for exploring space and for our national defense.

The Challenge of Space

The Tiros satellite supplies information about the weather, and the Early Bird satellite transmits television signals across the oceans. Launch rockets, such as Saturn V, send space craft to the moon and distant planets. At present, maximum effort is being made to land astronauts on the moon by the early 1970's. Fatal mishaps in the man-space program have raised criticism that would attempt to stop these programs as being too dangerous and wasteful of resources. Although the investment in material resources has been high, it does not begin to compare with the daily consumption of materials in even limited wars such as the current one in Southeast Asia.

Man in quest of adventure continually has new challenges to overcome. The pattern throughout history shows that he will either devote his energies to pushing forward into hostile environments, or he will turn to wars of conquest. There is little assurance that there will be any change in this pattern in the future. The application of human skills to solve problems required for man's existence in the low temperature and vacuum environment of space has accelerated developments of goods and services that will benefit mankind.

The Nature of the Job

The main components of either an aircraft or a space craft can be classified into three general categories. These would be structures, propulsion and systems. Systems would include instrumentation as required. The manufacturer of aerospace vehicles is usually under the technical direction of a prime contractor. He manages and coordinates the entire project, subject to periodic inspections by the agency ordering the vehicle. His engineering department prepares design drawings and other specifications. These go to production departments where the details regarding materials, processes and operations necessary to complete the vehicle are programed. The delivery and inspection of thousands of parts and sub-assemblies from sub-contractors must be coordinated to fit the final assembly.

The educational background and job skills required for the design and manufacture of aerospace vehicles varies from the advanced degrees of engineers and scientists to that of some plant workers who can learn their jobs after a few days or weeks of training. Some of the more important jobs in aerospace products manufacturing can be listed under three major categories: professional and technical occupations; administrative, clerical and related occupations; and plant occupations. Many of the jobs in this industry are similar to those found in other manufacturing industries.

Before production of an aerospace vehicle can begin, a design must be approved. This involves many experiments and feasibility studies to determine different possibilities that may meet the conditions in which the vehicle will be operated. Scale models that are made from improved designs are tested under simulated flight conditions. The next step

is to develop a full-size experimental model, or prototype, which is thoroughly tested both on the ground and in the air. If these results are satisfactory, production may then begin.

Usually many modifications in the craft are made during the course of design and development, and often after production has started. The rapidity of technological discovery often makes some equipment obsolete soon after production. Continuous efforts are being made to increase speeds, ranges, reliability and power through the application of new materials and concepts.

Aerospace engineers and scientists work in a wide and varied range of applied fields. They are assisted by many types of workers such as draftsmen, mathematicians, laboratory technicians, electronics technicians and similar supporting personnel. They also work with production planners, who plan the layout of machinery, movement of materials and sequence of operations, so that manufacturing processes will flow efficiently. Technical writers and illustrators are employed to produce technical manuals and other literature used to describe the operation, maintenance and service of aerospace vehicles.

Although the managerial and administrative positions in the aerospace industry may be comparable to those in other industries, they usually require a closer relationship to engineering, because of the importance of research and development in this field. This would include direction and supervision, research and production, as well as the officials in departments such as sales, purchasing, accounting, public relations, advertising and industrial relations. Many clerks, secretaries, stenographers, typists and other office personnel are also employed.

In 1965, about half of the workers in the aerospace industry were employed in plant jobs. These can be classified into the following groups: sheet metal working, machining and tool fabrication, other metal processing, assembly and installation, inspecting and testing, flight checkout, and material handling and maintenance. The minimum requirement for an engineering or scientific job in the aerospace industry is usually a college degree in one of the engineering specialties or in science.

Trends in Technical Education

As the sophistication of the technology developed, it created an upward shift in the technical preparation for the various levels of occupations. Engineering schools abandoned many of their specialized applications and hardware-type courses and moved more closely into the domain of the scientist. The press of competition and the explosion of scientific discovery has required that the engineer be at the threshold of scientific inquiry. As the engineering profession transcends to a higher operating level, a void is left, formerly filled by the so-called practical or applications-type engineer. The engineer will rely more heavily on the paraprofessional or technician and technologist, who is trained in a narrow field of specialization, in addition to having a fundamental background in the concepts of science and mathematics.

The team approach to scientific and engineering problems using the talents, training and skills of specialists focused on a specific endeavor has come into existence primarily since World War II. The technician, as the specialist in engineering applications, fills a vital role on the technical team. The original concept of the technician was primarily as an assistant to the practical engineer and as liaison between the latter and the skilled craftsman.

As the scientific frontiers were advanced, the responsibilities of each role were expanded. A greater emphasis was placed on theoretical engineering and the importance of research. Engineers are required to have a broad educational base with an understanding and depth of the principles of science. Engineers are functioning less as application specialists. With increased emphasis on the development of the scientifically-oriented engineers, there was a further increase in the applications gap that originally created the need for technicians.

The Engineers Council for Professional Development has classified the technical level of that portion of the continuum extending from the skilled craftsman to the professional engineer, which lies closest to the engineer, as "engineering technology". The technician is being assigned increasingly complex duties by senior engineers in such areas as supervision, construction, operation, production and certain phases of design. Although there is some rather widespread confusion over the term "technician", a definition has been proposed which identifies an engineering technician as "one who has an associate degree from a two-year engineering technology program." The term engineering technologist is defined as "a person who has completed the four-year baccalaureate degree

in ...g...eering technology." There has been a significant increase in the number of programs offering a baccalaureate degree in industrial or engineering technology. Some of these programs have evolved from two- a.d three-year engineering technology programs and others have grown from industrial options of the traditional industrial arts or industrial education curricula.

The Engineers Council for Professional Development has for a number of years recognized and granted accreditation to many two-year, post-secondary, technical programs. It is only within the past year that they have recognized and granted accreditation to a number of four-year technology curricula. This reflects in part the total shift in the technical preparation for the needs of industry and society in general. It also reflects the importance of providing the opportunity for the continuing education of the engineering technician.

The connotation of "terminal education" for the two-year schools discouraged many of the students from enrolling in such programs. This has been well illustrated by the fact that enrollment in technical institutes has been quite static for the past five years, while enrollments in four-ye... program... increased. The engineering technologist with a four-year bachelor's degree is l... to hold the same job title and receive the same salary as his more conventional counterpart, the BS in engineering. He is a much-sought-after middleman in the industry – part businessman, part technician, part supervisor, and oriented for manufacturing management.

Aerospace Technology – Kent State University

The four-year aerospace technology curriculum at Kent State University provides an example of a baccalaureate technology program that evolved from industrial arts. During World War II, several aviation courses were instituted at Kent in support of the defense efforts of the nation. After the war, additional courses in aviation were added along with the appropriate science and mathematics and general college requirements necessary to fill out a four-year degree program.

The original structure was oriented to the body of knowledge relevant to aircraft maintenance and also to the elements of flight. There were only a few graduates in the early 1950's from Aviation Technology. The title of the curriculum was changed to Aerospace Technology early in the 1960's, and several courses were revised accordingly. To date, there have been approximately 150 graduates from two options. The two options are the "science" option, which has a heavy concentration of mathematics and science in addition to specialized courses in aerospace subjects; and the "operations" option, which replaces some of the science and mathematic subjects with business and management-type courses, plus electives in professional flight courses for those who have that aptitude and interest.

A partial return on a survey being conducted of the graduates of Kent State Aerospace Technology indicates a high degree of acceptance by the aerospace industry for these people. The job titles of these graduates range all the way from chief engineer, product engineer, project engineer, on through to technical writers. In the professional flying category, several are aircraft commanders or captains on jet airliners and various other flight crew members, as well as air traffic controllers and other ground support positions. Although it is not my intent to suggest that the dollar sign be accepted as one of the major criteria of success, it is interesting to note that over one-third of these graduates have salaries above the $15,000 per year bracket.

Future Employment Picture

The United States Bureau of Labor Statistics predicts that during the next decade aerospace employment may fluctuate in the nature of application, but the total figure will not vary significantly through 1975. This projection assumes that major defense expenditures now being required for the Viet Nam conflict will not be necessary, and these resources can be reverted to peaceful applications.

A renewed emphasis on space exploration and the expansion of general aviation, as well as on the air transportation system, should provide tens of thousands of employment opportunities. It is estimated that there will be 20,000 to 30,000 job openings each year in aerospace occupations. The ratio of technicians to engineers is expected to increase over this period, resulting in a total greater over-all growth in this category than in many others.

Implications for Industrial Arts

As each new technology develops, it compiles its own body of knowledge and vocabulary

of technical terms. Many of the terms, materials, processes and concepts of the aerospace industry are unique to that field. As the research and development of new discoveries reach the manufacturing phase, a spin-off occurs that extends improvements into all parts of the economy. Industrial arts can provide a valuable function if these innovations are promptly included in the appropriate subject areas of the schools. The team approach to problem solving in materials, power technology, instrumentation, electronics and testing can be very effective in making the school population more knowledgeable about aerospace technology. The aerospace industry today represents a large, significant segment of our gross national product and the nation's economy. We cannot exclude the body of knowledge of this industry from the industrial arts curriculum without being guilty of neglect.

Mr. Otterson teaches at Kent (Ohio) State University.

W-6.12 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM AND COURSES APPLIED TO THE EDUCATION OF SLOW LEARNERS
Chm., Richard Birch; Rec., Melvin Klemme; Speakers, John Griffith, William Cochran, Leonard Hunter, Frank Sharkey; Host, Len Waitkus.

A UNIT APPROACH TO INDUSTRIAL ARTS FOR THE RETARDED CHILD

William A. Cochran

The mentally retarded student is an individual of habit, not reason, a person of doing, but not of thinking. Most of the time a person of normal intellect will learn to make daily adjustments without conscious effort, but because of the limited abilities of the retarded person, he must have more experiences of the same kind than the normal person in order to arrive at a given stage of efficiency.

The experience or instructional unit for the retarded should be a series of learning experiences which allow these students the opportunity to meet over and over again the types of experiences to which they are expected to adjust in their daily live

A successful instructional unit is one that is dependent upon the experiences of the students. Several years ago Christine P. Ingram listed three types of experience which these students should have. She explained them in this manner:

> Successful teaching and successful learning are dependent on 'child-experience'. The teacher's job is to guide the child so that this experience is worth while. For convenience in discussing the planning and carrying out of a unit of work, it may be helpful to consider the experience involved as of three types — the first-hand experience, the second-hand experience and the experience of expression.

All three types of experience are important factors in planning an instructional unit in industrial arts for the retarded class. The first-hand experiences mean the students are learning by direct participation with responsibility for the outcome. It is a part of life itself; a tangible experience that involves doing, which is commonly referred to as the basis of all effective learning.

But life cannot always be lived on this direct, concrete level. Even the experiences of the mentally retarded student involve some degree of abstraction. Inevitably their direct concrete experiences become associated with abstractions. The second-hand experience can be said to be a form of abstract experience. In the second-hand experience, models and other audio-visual materials replace the original experience. For teaching purposes, therefore, imitation is better than no experience at all.

A combination of first- and second-hand experiences will bring about the experience of expression. This experience is the doing, the acquisition of knowledge, the development

of simple skills and the attainment of the objectives for the unit.

Any curriculum for the mentally retarded should be an evolving one, subject to change as continued use and experimentation determine the need for modification.

Instructional units allow for deletions or additions to the curriculum, because these changes or modifications can be made without interfering with the objectives or goals of the entire curriculum for the retarded student.

There are several points that should be considered in planning an instructional unit. (1) The teacher must decide what his objectives are. One of the fundamentals of teaching the mentally retarded student is that the teacher realizes that the objectives for the retarded child differ from those for the normal only in degree and emphasis. Educational experiences for the retarded should be sequential, with the emphasis placed on practical application of all instruction.

(2) The teacher must try to base the unit on experiences that are common to most of the students in his class. This is especially important for the retarded because the teacher needs a common point of departure that is within the scope of his retarded students' experience.

(3) Using the common point of departure, the teacher should develop the unit in such a way that the unit will lead the class through a series of sequential, structured experiences. Built-in structure allows for flexibility; if one method does not work, try another.

(4) Do not set a time limit for the unit; the teacher may find the instructional topics are too difficult or need revision.

(5) Finally, the unit should be so constructed as to reinforce other areas of knowledge that are being developed in the school program for the "special student".

"Knowing Your Home" is an instructional unit that can be used as an illustration. The purpose of this unit is to develop an awareness of simple repairs, consumer knowledge and safety. This unit is an attempt to use the home of the retarded student as the basis for instruction. The home will be the common point of departure because the retarded student is familiar with things he has or must use in his home environment.

The main objectives of this unit are to: Develop knowledge of basic hand tools; develop some degree of skill in the use of hand tools; develop knowledge in how to perform simple repair jobs found in the home; develop consumer awareness; and develop safe practices in working around the house.

The unit is divided into four instructional topic areas: Where and how water gets into the house; where and how gas gets into the home; where and how electricity gets into the home; and general maintenance and repair.

Each instructional topic is sub-divided into repair information topics and consumer knowledge topics. The repair topics are the doing or first-hand experience, and the consumer topics are the second-hand experiences such as field trips and film viewing. The third-hand experience becomes the computation of the gas, water or electric bills and also a realization of a repair job successfully completed.

"Knowing Your Home" was written to reinforce a unit titled "Homebuilding". This unit is concerned with training the retarded student in the skills necessary for good home management. The purpose of the "Homebuilding" unit is to develop skills in the proper use and care of appliances, tools and general apparatus used in the home. Instruction is provided in the nutritional value, selection, preparation and storage of goods, as well as in how to select and care for clothing; sound financial home management is also stressed.

A coordinated effort on the part of the industrial arts and home economics teachers can make a real, concrete and meaningful educational experience for the special class by preparing the retarded students to become more effective members or providers for homes.

Mr. Cochran is Shop Supervisor for the Mason Occupational Training Center, Arlington, Va.

AN ACTION CURRICULUM FOR THE RETARDED CHILD

Leonard Hunter

An exploratory program in industrial arts titled "Pre-Vocational" has been in operation since 1964. It was designed to prevent drop-outs among low achieving or special

education students.

A total of 18 boys in the educable range of mental retardation (IQ 50 to 80) was enrolled in the program upon the recommendations of the guidance counselor, principal, teachers and school psychologist. Other requirements were that the boys had to be 15 years of age, had failed previous grades, had a high rate of absenteeism and might possibly drop out of school after reaching the legal age. After spending three years in the program and having regular attendance, the boys would graduate with a high school diploma.

Due to the lack of classroom and shop space, the class was located in a vacant school bus garage being used for storage. The boys can truthfully say they built their own classroom, since the first few months were spent cleaning and remodeling the building. They built walls, installed the heating units, revamped the plumbing, reglazed the broken windows, rewired the building, installed new lighting fixtures and painted the entire area.

This is a self-contained classroom and the students had the same teacher all day for their academic and shop classes. The school day consisted of morning study of academic subjects such as English, mathematics and current events. Whenever possible, these subjects were correlated with the actual remodeling of the building. English was taught as a means of communication, such as reading catalogues and writing purchase orders. Mathematics was coordinated with measuring, estimating job costs, estimating the amount of material and purchasing supplies. This type of instruction places emphasis on the practical use of knowledge and is far more interesting and beneficial to the slow learner than theoretical instruction.

All the boys were instructed in the safe use of all the power machinery and tools in the woodworking area. They constructed useful items, such as tables, gun racks, stools and bookcases. The boys sold their products to the public for their own personal profit.

A few of the boys showed an interest in automobiles and lawnmower engines. An old car and various engines were purchased so the boys could experiment. In order to learn the parts and the fundamentals of repair, they would disassemble and reassemble the engines. The boys were not expected to make major repairs, but only progress as far as their ability would permit. A few of the boys even overhauled cars and trucks.

Another group of boys showed an interest in automobile body repair and refinishing. Additional space was secured and the boys prepared a place to refinish automobiles. This was a high interest area, and even today there are ten boys enrolled in this class.

When a few of the boys wanted to learn more about carpentry and the building trades, the school system obtained a run-down house. The boys remodeled the house and it is now being used as a home management house for trainable girls.

At the end of the 1967-68 school term, thirteen of the original eighteen boys graduated with a high school diploma, four boys dropped out and one boy is still enrolled because of his entry into the program two years early. Five are married and three have children. Twelve of the thirteen graduates are working, three for building contractors, two as automobile mechanics, two in paint body shops, five work in various industries throughout the area, and the thirteenth is enrolled in college.

From the experience gained in this program, the boys have graduated from high school, found gainful employment and are on their way to becoming useful citizens instead of a burden on society.

Mr. Hunter is Coordinator for Special Classes, Connellsville, Pennsylvania.

W-6.13 AIAA
Special Interest Session
INDUSTRIAL ARTS AND THE WORLD OF WORK
Chm., G. Harold Silvius; Rec., Ned Sutherland; Speakers George B. Wilkinson, Thomas B. Hornig, Loyd VandeBerg, Alfred J. Hemaur; Host, J. George Williamson

INDUSTRIAL ARTS AND CAREER DEVELOPMENT

George B. Wilkinson

Career development is a concept which is being given considerable attention at the present time. In Philadelphia, as in other large cities, we are concerned with the number

of high school graduates who are unemployed while jobs go begging. We are concerned when critics point their fingers at these people to show that education is not doing its job. We are concerned about dropouts who might have been retained through an educational program that had real meaning for them. We are concerned about the adult who does not know where to turn when his job ceases to exist. All of this is within the context of our general topic for today, "Industrial Arts and the World of Work", and the specific topic, "Industrial Arts and Career Development".

Let us consider for a moment the term career development. The first thing that comes to mind as far as education is concerned is a traditional vocational program. Career development, as I refer to it, is much broader. It is a process which begins with the elementary school, continues through the middle and upper schools, and develops throughout the working life of the individual. It is not restricted to preparation for any particular job, or even for a particular trade or job cluster. It does refer to employment and is concerned with: (a) providing an awareness of occupational opportunities, professional as well as non-professional; (b) study of requirements and compensations of a variety of occupations; (c) development of a salable skill.

Career development is a concept that should permeate the total educational program. Education prepares one for life, with one's career, whether it be in business, industry or the home, being a factor of major significance in that life. It is a function of industrial arts to bridge the gap between the academic and the industrial worlds and to provide a way for career development within the educational framework.

But before considering industrial arts in its relationship with career development, it is essential to establish some common acceptance of what we mean by industrial arts. At the present time, I can identify at least six major recognized concepts of industrial arts that are being developed currently. There is no point in going into the various concepts at this time, but it should be noted that there tends to be considerable confusion as to exactly what direction industrial arts is to take, and even as to the function of industrial arts.

If industrial arts is to bridge the gap between school and industry, it must guide the youngster into industry at a level consistent with his aspirations and abilities. It must show him what opportunities are available to him, assist him in establishing career goals, and point the way toward achieving them. Specifically, it should provide the adequate on-the-job kind of guidance that will give him the feel of industry and help him make a realistic selection of a vocational program at the senior high school level, if this is the avenue best suited for him. If his interest requires training beyond high school, industrial arts should help him find his way. For one who is not interested in a vocational program, or who is not interested in post-high-school education of any kind, industrial arts should provide a broad background of basic skills and knowledge that have general application and are conducive to flexibility and adaptability with respect to the industrial world.

At this point, I hope I have defined what I feel is career development and what would be the function of industrial arts in broad terms with respect to career development. Now let us become more specific.

Time is of major importance in any educational program. I submit to you that the time allotted to industrial arts in the curriculum should be spent on the production part of industry and not the record keeping, advertising and marketing phases of it. Time now consumed by these activities could be used for career-oriented work. I am not implying that these activities are not important. On the contrary, I believe that they are of such importance that they should be taught by business education teachers who have specific training in these areas. And why can't industrial arts teachers work with social studies teachers in developing the historical background of industry? I'm sure some of you do. There are certain legal aspects of industry. Here, again, the business education and social studies people could help. And how about mathematics? Industrial arts teachers spend considerable time teaching youngsters to read a rule. They get involved in the teaching of fractions and decimals. Isn't there some way that math assignments can be coordinated with industrial arts work in the interest of efficiency? When industrial arts becomes involved in all of these fringe areas, there is little time left for the active "doing" part of industrial arts which gives the child real experience in what he's expected to do on the job. This is a contribution industrial arts should make towards career development.

When a youngster does get an opportunity for active work, it is seldom related to a career. Many times the youngster is involved in a certain industrial process and is concerned with only the process or with the end product. Quite often the work is project-

oriented, and the project becomes an end in itself, rather than just a means to an end. Why can't this work be consciously career-oriented through use of the Dictionary of Occupational Titles?

This brings us to another factor to consider. Assuming the most efficient use of time, and an accent on doing – which, of course, implies that the youngster is provided with the technical knowledge which enables him to do – how do we go about providing career information? In Philadelphia, the guidance department has inaugurated a program called "Room to Grow" at the fifth-grade level. Resource persons are brought in to discuss career opportunities in small groups. These are actual employees, engaged in a variety of occupations, who realistically discuss requirements, opportunities, rewards and limitations of their work. Many are local parents. Games are played to accent careers. There are coloring books and various reading materials, all of which are planned to help the child think in terms of careers. It would appear that the "Room to Grow" program has implications for industrial arts, particularly since many industrial arts programs throughout the nation are moving towards manufacturing and line production as areas of emphasis. It would seem natural to identify specific jobs and provide career information in this environment.

You must remember that I am speaking from the viewpoint of a large city industrial arts administrator, and some of my remarks may not apply as readily to programs in smaller communities. I do believe, however, that the problems are rather common, and that some of the things we will try should have general application.

In Philadelphia, we see career development as a team approach which involves guidance counselors, academic teachers, and practical arts teachers – that is, business, home economics and industrial arts teachers – working closely together to provide the child with the basic skills and broad knowledge essential to an intelligent career aspiration, selection and preparation. Beginning as a fifth-grade pilot program in a few selected schools, with September, 1968, as a target date, it is expected that the program will be extended eventually upward and downward to include grades K to 12. Industrial arts at the fifth-grade level would be an introduction to industry. At the sixth grade, we will explore the field of graphics; seventh grade, power and communications; and at the eighth grade, manufacturing and construction. This would be the middle school program for industrial arts, and it is here that major emphasis would be placed in the beginning. This emphasis would continue through the ninth and tenth grades in the upper schools in the belief that by the time a youngster reaches eleventh grade, he will be in a position to make an intelligent choice of a vocational program at that level or to continue to further general education.

At the present time, there are three problems: money, staff and program. Application has been made for funding as an innovative program. And, of course, we have great hope that it will be approved. If funds are made available, we will have a series of Saturday morning meetings, during which the administrative staff will meet with teachers of the schools in which the pilot program is planned and establish guidelines for development of a program. This coming summer, we expect to have a program directed towards teacher training, curriculum development and resolution of scheduling problems. It is expected that in the beginning the individual teachers will be thinking in terms of their specific subjects. It is hoped that during the course of the summer program these teachers will become members of a team who think in terms of a team approach and the contribution of their particular area to the broader objective rather than the traditional concept of individual teachers with respect to subject matter. It is expected that as a result of the summer program, teams will emerge with rather detailed curriculum materials to assist them in establishing pilot programs in their respective schools.

At this point, one may wonder just what the subject content may be, and, of course, we have no way of knowing exactly what it will be since it has not yet been developed. It is conceivable that there will be a product involved which will be designed and manufactured in the industrial arts classes to meet a market demand established as a part of business education. English teachers could explore careers in technical writing and advertising as related to a product. Spelling lists could include industrial terms. Graphic arts classes could provide advertising materials and labels while relating the work to specific employment opportunities.

However it is done, it is clear that a cooperative effort is needed and that no single educational discipline can assume total responsibility for career development. It is clear, also, that if industrial arts does not assume a major role in this very important aspect of education, it is rejecting a major reason for its existence and establishing a void to be

filled by some other means.

Effective vocational guidance is essential to career development. To be effective, there must be opportunity for the youngster to become actively involved. I submit to you the thought that the industrial arts laboratory is the proving ground for careers in industry. If we can fulfill this role, and work very closely with the other educational disciplines so that each has a part in career development, I feel sure that we will all be doing a better job.

Mr. Wilkinson is Assistant Director, School District of Philadelphia, Pennsylvania.

OCCUPATIONAL AND EXPLORATORY PROGRAMS FOR THE JUNIOR HIGH SCHOOL

Thomas B. Hornig

Children need occupational guidance from an early age. Since few families are able to provide the needed occupational guidance for their children, it must become an integral part of their education as long as they are in school.

Students need planned exploratory experiences in as many of the areas of the world of work as time and facilities permit, both in school and in the community. Because children are most likely to be influenced by occupations actually encountered, exploratory experiences must be provided during their junior high school years.

There exists a serious gap between the present instructional programs of most secondary schools and the real world of work. Many high school programs provide some experience for students in the 11th and 12th grades. These job exploratory experiences come too late to provide the students with adequate background and information for planning an appropriate program at the senior high level. Early on-the-job experience should be a positive motivating experience in preventing drop-out from occurring during the senior high school years.

Instructional programs must be developed to bridge the gap at the junior high school between the school instructional program and the real world of work. All areas of the junior high school program, with assistance from the guidance department, must provide the latest educational and occupational information needed to assist students in planning a realistic high school program of studies.

Occupational education and general education should not be separated, but should work together to carry on the culture of our nation, to benefit the public, business and industry, as well as to teach students to think, to choose wisely, to work and to live a fuller life.(1)

The World of Work project to be demonstrated at Judson Junior High School proposes to correlate the efforts of the entire faculty. This effort will be to close the existing gap between the modern junior high school and the world of work.

Most of the activities to be demonstrated are not new. Many have been successfully used by teachers for a number of years. The innovation will be that these activities will not be carried out in isolation, by one teacher here, another teacher there – but by the entire junior high school staff of 55 teachers. Our real test is how to get experienced teachers to change established methods of operation.

Since teachers must have a commitment before very much happens, we have involved them in helping to organize the program. We have provided in-service time for the development of learning packages. We have had informal dinner meetings of departmental teachers with administrators and expert consultants. We have secured reference materials, audio-visual aids and other instructional materials which teachers have identified as being relevant. We have taken teachers to see programs which have been identified as providing significant instruction.

At present we have a seventh grade and an eighth grade team operating in language arts and social studies. Through the eighth grade team, we have arranged an all-day field trip to study Oregon history, commerce and industry. Field trips are not new, but the logistics of planning for 380 students to go on a field trip has kept our administrators and teachers from doing this in the past. Through the efforts and organization of the same

eighth grade team, a community occupational and business survey will be conducted.

The seventh grade team is approaching the study of mankind through the medium of work: what man has done throughout the history of the world and the effect that science and technology have had upon the development of civilizations.

The math teachers are providing nine different levels of instruction for junior high students. This is a non-graded program. There are classes for students who have a comprehension level below that of the average 5th grader. Algebra and geometry are taught with six levels in between. At the suggestion of the math teachers, we are organizing a math lab. Initially students assigned to this class will not have reached a seventh grade level of math comprehension, even though they have been in the program two years. This third year in the math lab will complete their high school requirements. We will equip this laboratory with portable storage-work stations, each accommodating six students. Equipment will include all kinds of measuring devices, from rulers, squares and protractors to gages, scales, adding machines and cash registers. Eventually we hope to schedule this equipment for use in other classes of mathematics.

This past year during the section on careers, the ninth grade social studies teachers, with assistance from our counseling and guidance staff, arranged for 45 representatives of the business/industrial world to speak to ninth grade students during one afternoon.

In line with suggested changes in the industrial arts program, we intend to broaden opportunities for boys to explore the industrial world. Where we now offer a leather, metal, wood and drafting program, next year we intend to have metal, plastics, wood, drafting, electrical, graphic arts, power mechanics and construction operating.

In those areas where the school has little opportunity to provide instruction relating to the world of work, it is our intention to set up learning stations within the community for students who can profit from this experience. How far and how fast we move in this direction will depend partly on the level of funding our project receives. Leaders of labor and business have assured us of their cooperation in organizing this phase of the World of Work project.

FOOTNOTE

1. TenPas, Henry, "Philosophy of Vocational Education". Secondary Curriculum Reports, Volume IX, No. 2, Dec. 1966. Oregon Association of Secondary Principals, Commission on Curriculum Development.

Mr. Hornig is a Project Director in Salem, Oregon.

W-6.14 AIAA
Special Interest Session
NEW CONCEPTS IN INDUSTRIAL ARTS CURRICULA
Chm., Albert Paulter; Rec., LeRoy Crist; Speakers, Frank Burdick, Donald F. Smith, Joseph W. Duffy; Host, Ervin W. Bly.

RELATED ARTS: AN INTERDISCIPLINARY APPROACH

Frank E. Burdick

Related Arts, as it is taught in the Monona Public Schools, Madison, Wisconsin, is an example of an innovative curriculum experiment which was initiated and developed by classroom teachers. It is not a sophisticated project developed in the ivory towers of some great university by experts in curriculum theory and instruction. Rather, it represents a sincere in-service effort on the part of classroom teachers to improve their curriculum and design learning experiences that will be more meaningful to their students.

While this approach leaves some things to be desired, it has much in its favor from the standpoint of the commitment of the teachers involved and the actual fulfillment of the objectives by the students in the classroom. According to many experts, the involvement

of the classroom teacher in the curriculum development process is one of the most important aspects in the success or failure of any innovative program. Too often it seems there is considerable difficulty in actually bringing about the desired behavioral changes proposed by a new curriculum when the teachers are not involved in its development.

Related Arts had its beginning in 196? when the Superintendent of Schools appointed a curriculum evaluation committee made up of teachers from several of the departments within the junior high school. Because home economics and industrial arts did not exist in the junior high at that time, members of the high school industrial arts and home economics departments were assigned to the committee.

The purpose was to study the existing curriculum and determine the desirability for changes or additions. After several months of continuous dialogue and study, the committee came to the conclusion that the junior high curriculum should have a broad base and provide as many exploratory experiences as possible for all boys and girls. It was felt that maximum exploration was necessary if students at this level were to gain a sound basis for making more realistic decisions about their future educational and occupational endeavors.

In keeping with this basic philosophy the committee came up with the following recommentations:

(1) Add foreign language (Spanish and Latin) to the junior high curriculum on elective basis.
(2) Require some form of education in music for all students in seventh and eighth grade.
(3) Add industrial arts and home economics to the curriculum on a required basis for boys and girls in seventh and eighth grades, with boys taking home economics and girls taking industrial arts.
(4) Provide salaries for teachers to work in a summer curriculum workshop for the purpose of developing an integrated program involving art, home economics and industrial arts.
(5) Provide funds necessary for the purchase of equipment and supplies for the new program.

All of the above recommendations were approved by the Monona Board of Education, and work began at the beginning of the summer of 1963 for the development of the interdisciplinary program called Related Arts.

The dialogue that took place that summer in planning for the "new" integrated approach was difficult, to say the least. For the first time in their professional careers, each teacher on the team was forced to consider objectives and student needs from a point of view other than that of his own particular specialty. The industrial arts teacher, for example, had to think in terms of what objectives were valid for students in art and home economics, as well as what objectives were valid for industrial arts. While it was not expected that he be an expert in these other subject areas, it was important that he consider them so that he would understand more clearly the total purpose of the integrated approach.

Inter-departmental curriculum planning of this kind leads to spirited debate over objectives and content, especially when all departments involved are sharing the same time block in the schedule. It is utterly impossible, in such a process, to consider the reasons for a student's having more or less training in metals, woods, plastics or drafting without also considering the reasons for his having more or less training in design, family living, nutrition or creative expression. Student needs, interests and opinions become very important.

Finally, after long hours of discussion and study, the following objectives were developed:

(1) To develop initiative and independence through experiences which involve critical thinking and problem-solving techniques.
(2) To develop creativity in the application of the principles and elements of design so that learners may demonstrate more individuality in thought and work.
(3) To provide the learner with a variety of experiences so that he may discover new interests and further develop those which already exist.
(4) To assist the learner in adjusting to his environment through an examination of social roles and an evaluation of the expectations of his society.
(5) To develop basic understanding in the use of common tools and machines found in the learner's environment so that he may have a workable knowledge of their function and respect for their care and use.
(6) To assist learners in evaluating signs of quality in the purchase of materials

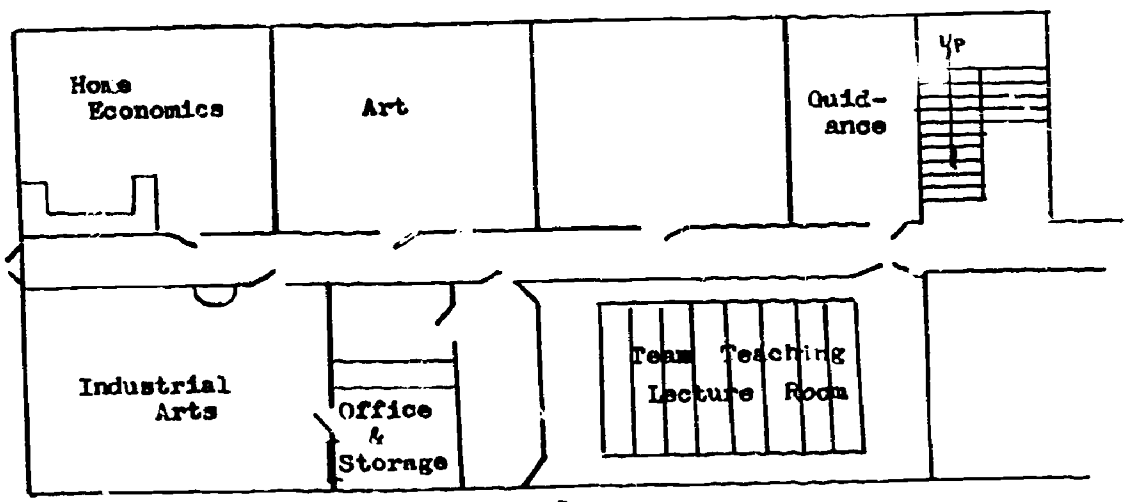
and objects found in their daily lives so that they may become more critical and more aware of the importance of wise buying and apply this knowledge in daily living.

(7) To guide the learner toward more successful relationships with peers and family through a better understanding of himself and his needs.

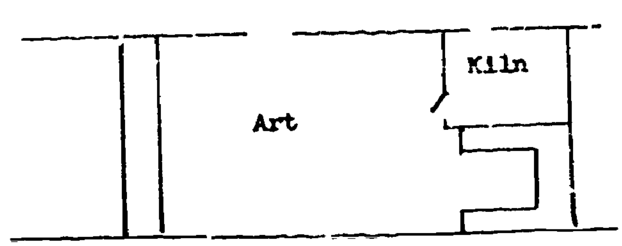
A great deal could be said here about objectives. Some industrial arts teachers feel that while objectives are necessary for the second or third page of a course of study, they don't really mean very much to the actual activities that go on in the shop. Others would say that objectives are extremely important in the determination of course content, and that they should become more and more significant in this regard. The Related Arts team was of the latter opinion, and we tried to keep objectives uppermost in our minds. Because of the limited scope of this presentation, it is impossible to go into great detail on the thinking that went into the development of the Related Arts objectives. I can only say that what we accomplished is our attempt to blend the individual departmental objectives into a totally new set of goals unlike those of any one of the three. While we succeeded to some extent in achieving this end, we also experienced a great deal of frustration and failure. I will elaborate on these later.

Once the objectives were developed we proceeded to the task of ordering the equipment necessary for the home economics and industrial arts lab. The industrial arts shop was designed basically as a general comprehensive shop. It is flexible enough to accommodate instruction in almost any of the common areas of industrial arts (woods, metals, electricity, drafting, graphic arts, etc.). The home economics room was also designed with maximum flexibility in mind. Trapezoid tables were used so that numerous arrangements could be worked out for planning, study, layout, design and other similar activities. A small kitchen area and several sewing machines were placed on opposite sides of the room to provide facilities for instruction in these areas. Most sections of art meet in the regular art room, which is equipped with a large kiln, large drawing tables, formica-topped counters, sinks and large storage areas.

In addition to the three rooms designed for home economics, industrial arts and art, a small team teaching lecture room was also provided nearby so that all three classes could be brought together at any time for instruction on integrated subject material. A general idea of the layout of the Related Arts program within the junior high building can be seen in the following sketch.



Ground Level
(New addition built to accommodate Related Arts program)



Second Level

Team teaching was very much a part of the program when we first began in 1963. We tried several different team approaches to the teaching of units in materials design and family living. One of the approaches we used brought all of the students together for the first quarter of the year into groups of about ninety. During this quarter, we attempted to explain the philosophy and objectives of the new program, and taught units in woods, metals, [illegible], fibers and design. We then broke up the large group into three smaller groups and rotated them through nine weeks in each of the three areas. The following diagram will give you an idea of how this kind of scheduling worked:

1st Qt.	2nd Qt.	3rd. Qt.	4th Qt.	
Team Teaching 90 per group	A	B	C	Home Ec.
	B	C	A	Ind. Arts
	C	A	B	Art

In subsequent years we tried a number of variations on this general idea – all with varying degrees of success.

Course content in each part of the Related Arts program is similar to that found in many traditional courses. The main difference is that the emphasis is on exploration, not skill refinement (as is all too often the case in many traditional programs). In addition to this, we have tried to place emphasis on overlapping areas of instruction, such as design and materials, in order to show the relationships among the three disciplines and thereby make learning more meaningful. Projects designed to begin in one section and continue to their completion in the other areas are one way of accomplishing this objective. It is not an easy task, however, to design projects that will lend themselves to this kind of sequential development, and we have experienced considerable difficulty in making this approach work effectively. For example, one project idea that was developed involved a lamp that was to be designed in art, the base and lampshade frame constructed in industrial arts, and the fabric portion of the shade completed in home economics. While this idea worked well for the students who rotated through the areas in this order, it did not work for the other students who rotated through the program in a different sequence. In these cases, entirely different projects were necessary and were not easy to come by.

It should be pointed out here that it soon became evident to the Related Arts team that there were certain incompatibilities between art and the other two subject areas. One example of this is evidenced in the sequential project approach mentioned above. It was very difficult for the art teachers in the team to relate to any kind of structured activity. Their philosophy concerning how to develop creativity within the student rendered most pre-planned projects objectionable. A directed type of project is thought to inhibit the child's ability to create something original and unique. Many hours were spent by the team in debate over the meaning of creativity. It is a problem still unresolved at this time.

This brief description of our Related Arts program will give you a general idea of what is expected from the students and what actually goes on in the classroom. It also tells about some of the team relationships we experienced. Now I will go on to point out some of the major strengths and weaknesses that we have identified and give you a brief idea of what we expect to do in the near future to improve the program.

The process of inter-departmental curriculum planning is by far the most important strength of the Related Arts program. It is utterly impossible in this kind of approach to change objectives or content without regard for the effect such changes have on the total program. The student is treated as a "whole person". He cannot be divided up into several different autonomous parts that compete with each other for an outlet in the curriculum. Those of us who have worked together on the Related Arts team feel that the inter-departmental approach should be broadened to include all departments within the school. There are many hopeful signs that such a trend is beginning to manifest itself on

the national level, and we expect that, as a result, inter-departmental curriculum planning will become more and more prevalent at the local level. We need desperately to brake the "lock-step" departmental approach to curriculum planning.

Other strengths of the Related Arts program would include the following: (1) The improved quality and attention given to objectives and their importance in the selection of course content; (2) the excitement and stimulation (as well as frustration) experienced from working in a team rather than in isolation; and (3) the continuing challenge to keep the curriculum meaningful and dynamic, thus making it difficult for "ruts" and fixed courses of study to entrench themselves.

Finally, a word should be said about the positive value of the concept-oriented approach used within the Related Arts program. Our goals are directed towards such things as, (1) the improvement of self concepts, (2) increased creative ability, (3) improved critical thinking and (4) awareness of personal values. We do not expect students to learn and remember large amounts of factual knowledge or develop very refined manual skills. Instead we hope to develop broader concepts so that the student will be better able to make realistic decisions concerning his education and vocation in future years.

It became increasingly clear as time went along that one of the most difficult problems we faced in our experiment was that of being confused about our own individual departmental objectives. This was especially true in industrial arts. Should the emphasis be on the development of vocational skills or should it be on consumer education, worthy use of leisure time, understanding of industry or the knowledge of applied science and technology? Each teacher in the program began to feel this same sort of frustration. The art teachers felt that the students were not getting enough time to develop their artistic abilities in various art forms, and the home economics teachers felt more should be done in sex education and family living.

As I have said before, it is not possible to make adjustments in one area without considering what effect such adjustments will have in the other areas. If each course maintained its own individual spot in the curriculum, adjustments could be made with no regard for the effect they might have on the other subject areas.

In order to clarify what each department felt was most important for junior high boys and girls, we decided to separate from the team and return to individual departmental curriculum planning.

This return to the traditional curriculum approach on a separate departmental basis is temporary. We will return to the team effort as soon as we have reached agreement concerning our own individual departmental objectives.

As a result of the debate that has taken place, it has become increasingly more difficult to agree on basic philosophy and objectives. While there are indeed many overlapping objectives among the three subject areas, there continue to be a great many unique aspects of each part that do not blend well together. Art, for example, objects to the home economics or industrial arts point of view toward the meaning and purposes of design. It also has great difficulty agreeing with home economics and industrial arts on the definition of creativity.

Because of these basic differences of opinion, a new idea has presented itself and is currently receiving considerable support. This is the idea that we move the art section out of its current place in the Related Arts program and schedule it into a block of time shared with music. Such an arrangement would provide an excellent opportunity for the fine arts disciplines (art, music, drama, etc.) to begin discussions concerning the development of new courses in the humanities.

Coupled with this idea is the suggestion that we add business and distributive education to the Related Arts program in place of art. After several years of experience it appears that there are more similarities between home economics, industrial arts and business education than there are between home economics, industrial arts and art.

It must be pointed out, however, that we are speaking about a business and distributive education program that is considerably different from most traditional courses. Our business education will stress consumer education and the interrelationships between business, industry and technology. It will not be a skill development course in personal typing. It is not difficult to see the similarities between these objectives and those of home economics and industrial arts. The possibilities for projects in such things as home and family management, junior achievement and occupational guidance are endless.

Some may say that we have retreated from a challenge in our experimental project because we now recommend that art be transferred out of the program. This may be true to a very limited extent, but we are quite confident that the experience we have had

has been fruitful for both teachers and students. We feel that our suggestions for change are not a retreat, but rather a positive step made on the basis of long study and experience. There are many exciting opportunities and challenges ahead in both Related Arts and the humanities. Hopefully we will be able to meet these challenges successfully.

Mr. Burdick is Coordinator of Industrial Education, Monona Grove High School, Madison, Wisconsin.

W-6.15 AIAA
Special Interest Session
NEW CONCEPTS IN CURRICULUM IN INDUSTRIAL ARTS
Chm., George Litman; Rec., Herman Collins; Speakers, Elmer S. Ciancone, Rex A. Nelson, Donald Hackett; Host, L. Kent VanMeter.

WHO HAS THE CURRICULUM?

Rex A. Nelson

The new concept in curriculum development in industrial arts for this discussion is not so much of idea as of responsibility. With an evolving new concept in curriculum development comes the question of where does the responsibility lie to put the curriculum into action? This question essentially has two parts: first, who has the responsibility; and second, how is the curriculum to be put into action?

Howard Nelson stated that: "The strengthening of industrial arts programs does not require overcoming an immediate, serious crisis in one concerted thrust. Instead, more effective programs will result from a continuing effort by classroom teachers who know the direction toward improvement."(1)

The recognizable fact in this statement is that effective programs are the product of knowledgeable teachers. Another fact is that the keys for developing a teacher are in the hands of industrial arts teacher educators. Some of these keys are: The requirements for the baccalaureate degree, NDEA institute programs, and courses for higher degrees and certificate renewal.

Do teacher educators take advantage of the opportunity provided by these keys or are they serving the same "old menu"? Do teacher training institutions purposefully give the teacher experience opportunities for improvement? How much opportunity does a teacher have to improve in a course, workshop or institute in Wood Finishing? A topic such as this certainly does not lend itself to breadth. Not only does it eliminate other industries for study, but it also stratifies within the wood industry.

The reason for such technical study is usually well intended. It is assumed that this is an in-depth study in a teacher's specialty. When teacher educators recognize the fact that the educational specialty of the industrial arts teacher is industrial arts, instead of some material, tool or manipulative skill, then they will be able to give in-depth study. The teacher educators need to recognize fully that skills with tools, machine operations and materials processing are tools for learning with which the teacher works. The need for these tools is obvious but knowing how to use them intelligently for teaching is essential.

Why does it seem so difficult for teacher training institutions to accept the responsibility of training an industrial arts teacher? Possibly one of the reasons is prestige. Is it little wonder that many industrial arts teacher training institutions have allowed the responsibility for training teachers to become secondary to satisfying the needs of industry, where monies come as gifts, endowments, grants and consulting fees? When it comes to choosing between working with a demanding industry and the reluctant public, it can be understood why the choice is usually industry. Can the teacher training institutions really be blamed, when on one hand they are "fighting off" industries who demand programs with dollars to back up their demands, and on the other hand the purchasing of paper clips is a major decision?

Somehow teacher educators, as well as others, need to recognize that the most im-

portant "raw material" of our society is our youth, and that the most important "industry" is the educational programs which shape that "raw material". Industrial arts teacher educators need to recognize and accept the responsibility to synthesize the content, method, skill and "raw materials" and to develop a "production line" whereby industrial arts teachers can be taught as teachers and not as pseudo engineers, pedagogs, technicians or material craftsmen.

A parallel result of purposeful action can be drawn from industry. Just as an industrial product tends to perform as it was produced, a teacher tends to teach as he was taught. Even with this example and information, teacher educators have a tendency to attempt to develop their product with isolated and non-related courses. They present technical materials or skill courses which are not designed for teachers but for people preparing for industrial vocations. Methods and techniques of education are presented separately from content. The unique techniques and methods of teaching industrial arts are taught separately from both the understanding and application skills of education. After presenting segregated skills, techniques, methods and materials, the teacher educator still expects the teacher to go out in the field and somehow miraculously unite these to present youth with experience for understanding industry.

One step forward would be for teacher educators to begin training teachers in model laboratory situations that are feasible and economically practical in the general education program. Teacher educators need to come out of their "ivory towers" and recognize the real world of work where their product, the teacher, is to function. More simulated and role-playing opportunities need to be presented to teacher trainees. The method, content and skills of teaching must be fully integrated with an understanding of human learning and the total general education process to bridge the credibility gap between learning and application.

Another step would be fully to recognize industrial arts in the university as teacher training, and to see that the program is: first, to aid in the training of a teacher; second, to give that teacher a piece of the general education program with which to work; and, third, to aid the teacher in integrating the unique skills, methods and content of industrial arts with the total education program. Besides these three, industrial arts teacher educators need to recognize that they are teacher educators, not pseudo engineers, industrial technicians or materials craftsmen, and cooperatively join others who are in the business of training teachers.

Unless teacher educators recognize and accept the responsibility of putting concepts of curriculum into action and begin training teachers as teachers, industrial arts will continue to be in the re-treading business. Industrial arts teacher educators need to take a look at their raw material and the tools available to shape it and begin purposefully to process the raw material into a finished product. The raw material is the beginning teacher trainee and the finished product is a resourceful and skilled industrial arts teacher who understands his role, content and method and can apply these in helping youth understand industry.

FOOTNOTE

1. Nelson, Howard, "Evaluation Guidelines," 16th Yearbook, American Council on Industrial Arts Teacher Education. Bloomington: McKnight, 1967, p. 5.

Dr. Nelson is Associate Professor in Memphis, Tennessee.

W-7.3 AIAA
Activity Session

ERIC, THE NATIONAL INFORMATION SYSTEM FOR AMERICAN EDUCATION—ITS IMPLICATIONS FOR INDUSTRIAL ARTS

Chm., G. S. Wall; Rec., Donald Froelich; Speaker, Robert E. Taylor; Hosts, Howard Ringold, William C. Frolund.

E.R.I.C. AND INDUSTRIAL ARTS

Robert E. Taylor

I very much appreciate this opportunity of meeting with leaders in the American Industrial Arts Association. We have had fruitful discussions with your President, Ralph Bo n, and Executive Secretary, Howard S. Decker, concerning developments at the ERIC Clearinghouse on Vocational and Technical Education to more effectively serve your professional needs. We have also benefited from the counsel of Dr. John Rowlett, Professor of Industrial Arts at Eastern Kentucky State College who serves as a member of our Advisory Committee.

The Educational Resources Information Center (ERIC) was established within the US Office of Education to provide a national decentralized information storage, retrieval, and dissemination system for American education. This system consists of Central ERIC and 18 clearinghouses representing specific substantive areas specified by USOE. One of these, the ERIC Clearinghouse on Vocational and Techr .cal Education (VT-ERIC), is responsible for industrial arts education, occupational psy ology, occupational sociology, manpower economics, new emerging sub-professional fields, and vocational and technical education. Each clearinghouse is responsible for acquiring, abstracting, indexing, and disseminating all appropriate materials within its scope. Documents that are of national interest are forwarded to Central ERIC for computer processing and to the ERIC Document Reproduction Service (EDRS) for filming and processing to microfiche form. Microfiche is a flat form of microfilm, each of these represents sixty to seventy pages of the document and sell for twenty-five cents each. Hardcopy of ERIC documents are also available.

One of the major products of the ERIC system, and its primary vehicle, is the computer-generated monthly publication, Research in Education (RIE), which is printed and distributed by the Government Printing Office (GPO) and is available by subscription for $11 per year. Each issue of RIE contains information on completed research or research related information, and newly funded research by USOE. Information is presented in the form of resumes containing abstracts and descriptors of documents processed through the ERIC system. Also included are several indexes which make it possible for individuals to locate information on specific topics or by certain authors. The VT-ERIC Clearinghouse at The Center for Vocational and Technical Education is also using publications as a primary means of disseminating information. The two publications currently produced are Abstracts of Instructional Materials in Vocational and Technical Education (AIM) and Abstracts of Research and Related Materials in Vocational and Technical Education (ARM) which have been produced on a quarterly basis since the fall of 1967 and are available as two separate series. AIM primarily reports instructional materials while research and research-related materials are reported in ARM. Copies of these are sent to head teacher educators and head state supervisors in industrial arts education. Budget limitations preclude wider free distribution; therefore, arrangements have been made to allow subscriptions to these publications from The Center for Vocational and Technical Education at a cost of $9 each per year. These publications also include resumes and several indexes.

The principal means of transmitting information about a document in any ERIC publication is the resume which has four major sections: (1) Clearinghouse and ERIC identification; (2) bibliographic information; (3) the descriptors; and (4) the abstract. The first section might contain these numbers to identify the document, VT 003 145 and ED 013 949. The ED 013 949 identification is the number to use when ordering microfiche or hardcopy from EDRS after reviewing the resume. Documents with VT designation only are usually materials which have a local or regional focus and would be announced in an issue of ARM or AIM. Section two typically includes information such as title, personal author, source of the document or the publisher, series numbers such as BR-5-0059, the publication date, an availability statement which gives microfiche and hardcopy prices, and the number of all printed pages including the cover. The third section contains the descriptors (index terms) assigned to the document for retrieval purposes. Descriptors marked with an asterisk represent the major concepts in the documents and are used in ERIC publication subject indexes. The final section provides an

abs‘ract of approximately 200 words or less that describes for the reader the content of the original document. If there is a publishing source which sells the document, this information is included at the end of the abstract. Whenever a hardcopy is desired, it will cost less than a hardcopy from EDRS. The initials at the end of the abstract are those of the document analyst who has written the abstract.

Microfiche of the items in AIM or ARM without the ED designation may also be obtained from EDRS, but not as individual documents. Materials announced in each issue are continuously filmed on microfiche under a single ED number. This permits the purchase of a microfiche collection for any single issue of AIM or ARM from EDRS. Interested persons or organizations may subscribe to these microfiche sets by sending a $50 deposit to the ERIC Document Reproduction Service and requesting the usual deposit procedure for these microfiche sets. Estimated cost for all eight sets (a year's input) is $300 per year. Subscribers to microfiche materials in Research in Education will automatically receive these sets.

In some states certain agencies, such as the Research Coordinating Units (RCU), will obtain these collections and the equipment to reproduce microfiche or hardcopy of individual documents. Several indexes to the materials are also included in each collection. University libraries are also interested in developing these collections.

Examples of the types of materials desired by VT-ERIC are: instructional materials, research reports, conference reports, bibliographies, etc. Any person who has copies of such materials or who is involved in production of materials pertaining to vocational and technical education should forward two copies of each document to the ERIC Clearinghouse on Vocational and Technical Education. The materials should be directed to the attention ot the Acquisitions Specialist at the ERIC Clearinghouse, 980 Kinnear Road, Columbus, Ohio 43212.

What can you do to optimize the benefits from the ERIC system to you and your profession?

(1) Actively participate in the acquisition of materi   or the system. Assure that the significant literature of your field is availabl   ll.
(2) Subscribe to the monthly publication, Research in   ation, and the two quarterly publications, Abstracts of Instructional Materi   Vocational and Technical Education (AIM) and Abstracts of Research and   ted Materials in Vocational and Technical Education (ARM) and to the r   ofiche series. In addition to having these readily available in your departi   it, school libraries and other information resource centers should acquire the   materials.
(3) Procure microfiche readers and other needed e   pment.
(4) As a leader, inform your staff, graduate stud   ts, and teachers how to utilize the system.
(5) Share with me or the Coordinator your ideas and suggestions for improving the system.

Dr. Taylor is Professional Education Director at The Center for Vocational Technical Education, Columbus, Ohio.

W-7.4.1 AIAA
Reports of Research
INDUSTRIAL ARTS
Chm., Peter Jackson; Rec., Theodore Davenport; Speakers, Emil H. Hoch, Gene A. Crowder, John Entorf; Host, James Kochevar.

SLIDES AND MODELS VS. CONVENTIONAL METHODS

Gene A. Crowder

Models are utilized frequently in instructional methodology, but an investigation of their effectiveness in relation to the perception of the individual student has not been

adequately studied by researchers in industrial education. This study was an attempt to investigate a learning environment which utilizes visual slides and manipulative models for the purpose of partially bridging the gap in methodology research.

The purpose of this experiment was to compare the relative effectiveness of instruction, when presented with slides and individual assembly models, with conventional instruction in selected units of general shop.

The problem consisted of (1) preparation of visual slides and a related model for each selected unit of general shop, (2) presentation of these units to a representative sample of students enrolled in general shop classes, and (3) determination of the value of these aids relative to conventional instructional methods.

The study involved 280 students divided into equal groups. Sampling was from the public secondary schools. The information presented to the students was determined primarily by a jury's selection of three units of instruction which were presented by the experimental method. The experimental procedure involved (a) teaching the experimental group through instruction in which informational units are presented through the use of visual slides, in conjunction with an individual assembly model for each student, (b) teaching the control group by conventional methods only, (c) measuring each student's learning after the presentation of each unit, and (d) measuring each student's retention six weeks after the presentation of each unit.

The analysis was designed to test the following hypotheses: (H_1) There is no significant difference in learning when predetermined units of general shop are presented by use of visual slides and models than when presented by use of conventional methods of instruction: (H_2) Units presented by the use of visual slides and models are as effective for lower intelligence groups as for higher intelligence groups.

Statistical inference was based on analysis of variance and student's t-test. Analysis was for the effects of mental ability and for the effects of method. The .05 level of confidence was chosen as the test criterion.

The analysis of data in the investigation indicates the experimental method of instruction to be more effective than the control method. No statistical analysis showed the control method to be superior. The experimental method was statistically proven to be superior for initial learning, for retention and for both higher and lower intelligence groups.

Data analysis also indicated that students of lower intelligence, when taught through the experimental method, achieved at the same level as the higher intelligence group taught by the control method. This factor has significant implications in isolating methods of instruction for students of lower intelligence. The higher intelligence experimental group also achieved at a greater level than the higher intelligence control group.

Many effective teaching methods are isolated or developed through research, and the teaching profession should be aware of these methods and encouraged to use these proven methods in their classrooms. Individual unit models have been proven through this research to be an effective method of teaching in certain areas of industrial arts. Industrial arts teachers should become familiar with this type of instruction and use models and slides when the instructional unit lends itself to this method.

Further research needs to be applied to audio-visual instruction in industrial education. A study comparing the effectiveness of models and slides to that of overhead projectual transparencies would be a worthwhile investigation. A study isolating the comparative effectiveness of aural stimuli, visual stimuli and tactual stimuli in teaching industrial subjects also should be undertaken. A repeat of this type of study in other areas and units of general shop would be desirable.

Mr. Crowder is Assistant Professor of Industrial Arts, University of Southern Mississippi, Hattiesburg.

INDUSTRIAL EDUCATION AND VIDEO-TAPE RESEARCH REPORT

John F. Entorf

This investigation was conducted to compare the effectiveness of video-taped, closed-circuit television with the conventional lecture method in teaching selected related technical information in beginning woodworking.

One hundred fifty-three students enrolled in six class sections were randomly assigned to a control and experimental group and taught four units of related technical information by the two methods. The two groups were rotated through the four units so that each group received two units by video-tape and two units by conventional lecture. The informational content for each unit was identical for both groups, and all visual aids used in the production of the video-tapes were made available for the lecture method.

The criteria used to evaluate either method were (1) initial learning of subject matter immediately after each unit was presented and (2) retention of subject matter four and fourteen weeks after instruction. Student knowledge of subject matter was measured by administering a one-hundred-thirty-item achievement test three times: once on a unit basis and twice as a single instrument. Student opinion toward both methods was determined by administering a questionnaire.

The data gathered from the results of the achievement test were analyzed using the analysis of variance technique and the pooled t test. The questionnaire was evaluated using the X^2 approximation to the normal distribution.

With a single exception which was non-significant, the video-taped method resulted in higher mean scores for every unit on all three administrations of the achievement test. Measured over the four units, this difference was significant at the .01 level of confidence for the unit test, post test and retention test. On the unit and post test administrations, there was an interaction between units and methods significant at the .01 level of confidence. No significant interaction between units and methods was found on the retention test. Comparison of the two methods on a unit basis isolated only one unit that consistently contributed to the difference between methods; Unit IV contributed significantly to the difference between methods at the .05 level of confidence or above on all three administrations of the test.

Analysis of the questionnaire revealed that students preferred the lecture method and believed that it covered the material more thoroughly than the video-tapes. The students objected to the video-tapes because they were unable to take comprehensive notes or ask questions during the presentation of a taped lesson.

Based on the analysis of the data gathered, it was concluded that students taught by the use of video-tapes scored significantly higher on the achievement test when measured over the four units for both initial learning and retention. The significant interaction between units and methods for the initial learning and retention at four weeks indicates that some units were more appropriate for video-taping than others; it would appear that related information units covering closely related material that can be presented in a single, video-taped lesson of no more than twenty minutes' length are most effective.

Dr. Entorf is Metals Chairman at Stout State University, Menomonie, Wisconsin.

W-7.4.2 AIAA
Reports of Research
IMPROVING CURRICULA AND LEARNING
Chm., R. Thomas Wright; Rec., Kenneth Thompson; Speakers, Duane M. Mongerson, Donald Clark, Robert E. Magowan; Host, John H. Millard.

LEARNING PRAXIOLOGICAL CONCEPTS

Donald L. Clark

Is overt activity a requisite in learning praxiological concepts?

Throughout history man has searched for the most effective and efficient method to transmit his accumulated knowledge. One segment of this is his knowledge of practice, knowledge concerned with how to "do" effectively, or, stated another way, his praxiological knowledge.

In industrial education the "doing" aspect in the various instructional laboratories is based upon the premise that through overt activity the student will learn the concepts

of our industrial world. That is, how does industry "do" or produce? The theory is that if the student overtly does what is being done in industry, he will acquire an understanding of industry.

There are learning theorists who agree that there must be overt response before learning can take place; other theorists claim overt activity is not necessary. One factor which has contributed to this dichotomy has been the knowledge categorization system used by these theorists. Learning embraces the whole of man's knowledge. Traditionally, however, this knowledge has been categorized into formal, descriptive and prescriptive divisions. It is in relation to this categorical breakdown that most theories of learning have developed. If a fourth category, that of praxiology or knowledge of doing, had been considered, there may have been modifications in some of these theories. Can knowledge of how to "do" efficiently be acquired through traditional or "covert" learning activity, or does "overt" learning activity provide for more effective transmission of praxiological knowledge? As little evidence is available to support a forcible answer to this question, this study was designed to help in the formulation of a sounder theory about the effective teaching of praxiological concepts.

In this study, two methods of instruction were used in teaching an industrial praxiological concept to 142 junior high school boys in seven separate industrial arts classes. Each class was given the same basic presentation via video tape. This was followed by one-half of the students in each class conceptualizing about how to "do" the activity. Evaluation of each method of instruction was achieved by means of analyzing the performance of each group on a performance test. The performance of the practice group during their practice session provided control data for the study.

Bending electrical metallic tubing (EMT) with an EMT bender was selected as the praxiological concept. Its selection was based on its being a unique and unfamiliar concept to most junior high school students. Also, with this activity a problem could be designed which was complex enough to challenge the able student yet simple enough to allow most students to feel a sense of accomplishment.

The findings revealed that in general the student who had had the overt practice outperformed the student who had only conceptualized about the activity. This finding was substantiated on overall achievement as well as on part scores.

A further finding that substantiated the need for and value of practice was that as the group which had conceptualized completed successive units – each unit being a form of practice – their mean achievement became more nearly that of the practice-performance group; however, the amount of practice required to attain a given performance level was smaller for the conceptualization group than it was for the practice group.

Performance scores were compared according to seven separate ability factors; each had a positive effect in that the higher the individual student ability, the higher his achievement on the praxiological concept. Of the seven factors, motor skills ability and spatial perception attained the greatest significance. General ability, mathematical ability, communication skill and academic ability were revealed to have more effect on selected individual operations than on overall performance. IQ did not attain significance; however, it appeared that conceptualization prior to performance was beneficial to the lower ability student.

The overall findings of the study generally indicated that in teaching a praxiological concept, the emphasis should be placed on overt activity.

Based upon:

"Activity and Learning: An Experimental Comparison to Determine the Efficacy of Overt Versus Covert Activity on the Learning of an Industrial Praxiological Concept." Unpublished doctoral dissertation, The Ohio State University, Columbus, Ohio, 1967.

Dr. Clark is Associate Professor with the Department of Industrial Education, at Texas A & M, College Station, Texas.

DEVELOPING CREATIVITY IN DESIGN

Robert E. Magowan

The question that instigated this research was: which is best for developing students in creative design, pragmatic problems or hypothetical problems?

For the most part, pragmatic or practical problems have been used to teach designing. These problems emphasize the solutions of utilitarian situations.

Some instructors of designing have used hypothetical problems which emphasize the solution of supposed situations, assumed without proof. The purpose of this research was to determine if there is any difference between the pragmatic or hypothetical approach to product designing for developing aesthetic awareness, a quantity of ideas and unique ideas.

In an attempt to discover the difference between the two types of problems for influencing creativeness, I conducted an experimental investigation at Texas A&M University. The experiment included ninety-eight architecture students enrolled in a general materials course and forty-two industrial education students enrolled in a general woodworking course.

The students in each class were randomly divided into pragmatic and hypothetical subgroups prior to the investigation. The experiment was initiated with the administration of the Barron-Welsh Art Scale and Form A of the AC Test of Creative Ability. The Barron-Welsh Art Scale is a test to determine the student's preference regarding various drawn figures. The student merely records whether he likes or dislikes the figures. This test gives information regarding the student's aesthetic awareness.

The AC Test of Creative Ability has three parts. In the first part, the student lists consequences for each of five possible situations. In the second part, the student is to list reasons to explain the truth of a number of statements, and in part three the student is to list uses of common objects. This test gives information regarding quantity and uniqueness of ideas.

In order to insure that each student received the same type of instruction on designing, a booklet on creative design was developed. The booklet was intended to encourage the student to design creatively and to give him a guideline for problem solution by a working example. Each student who participated in the experiment received a copy of the booklet and was instructed to study the contents and answer the ten questions at the end of the booklet.

Following the pretest and booklet on creative design, the students were administered the first pragmatic or hypothetical problem. Thirty minutes were allowed to sketch as many ideas as possible to solve the problem. The students in each subgroup worked their problems in different parts of the room.

One subgroup of each class received pragmatic problem number one which requested that they design some functional eating implements. The other subgroup of each class received hypothetical problem number one, which was parallel to the pragmatic problem but contained a hypothetical situation. Hypothetical problem one was to design some functional eating implements but for a hypothetical hand – one that had two instead of five fingers.

Another pragmatic problem issued at a later date required that the students design a seating device to support the human body comfortably in a sitting position. The parallel hypothetical problem was to design a seating device but for a three-legged space creature.

A total of six problems was administered to each subgroup of each class in six class meetings. One problem was given and completed by the student during each class meeting.

Upon completion of the entire series of pragmatic or hypothetical problems, the students were given the Barron-Welsh Art Scale and Form B of the AC Test of Creative Ability. The re-testing of the students concluded the actual experiment. The tests were evaluated according to the instructions given in the test manuals.

The research was designed to test the hypotheses that no significant differences existed between the pragmatic and hypothetical approaches to product designing for encouraging the development of (1) aesthetic awareness, (2) a quantity of ideas and (3) unique ideas. These hypotheses were tested using (1) all of the students in the experiment, (2) the architecture students and (3) the industrial education students. The hypotheses concern

ing quantity and uniqueness of ideas were further tested using the same groups of students after they had been divided into (1) those who had a mean pretest quantity score or above and (2) those who had a pretest quantity score below the mean on the AC Test of Creative Ability.

The data utilized for the analyses consisted of the raw score differences between the pretests and retests. The data was analyzed at the .05 level of confidence with the analysis of variance, two-way classification for unequal and disproportionate subclass numbers.

The conclusions derived from this research are as follows: (1) Students subjected to a pragmatic or a hypothetical approach to product designing will not develop differently in aesthetic awareness. (2) When all creative ability levels are considered, students subjected to a pragmatic approach to product designing react no differently in producing a quantity of ideas from students subjected to a hypothetical approach to product designing. (3) Architecture students who have above average creative ability produce a greater quantity of ideas when subjected to a pragmatic approach to product designing rather than a hypothetical approach. (4) Students subjected to a pragmatic approach to product designing will not differ in the number of unique ideas they produce from students subjected to a hypothetical approach.

An empirical analysis of the study revealed that neither method is effective for developing aesthetic awareness; however, pragmatic and hypothetical problems in product designing were both instrumental in increasing the quantity and uniqueness of ideas produced.

All creative ability levels and above average creative ability levels did better after working pragmatic problems, and low creative ability levels did better after working hypothetical problems.

This study suggests that problems are valuable to teach design. The student should be confronted with pragmatic or hypothetical problems, or perhaps a mixture of the two types, to increase his ability to develop creative, unique solutions.

Dr. Magowan is Chairman for Manufacturing Techniques at Memphis State University, Tennessee.

W-7.4.3 AIAA
Reports of Research
IMPROVING STUDENT TEACHING THROUGH PORTABLE VIDEO TAPE RECORDERS AND MICRO-TEACHING TECHNIQUES
Chm., Edwin C. Hinckley; Rec., Harold T. Houghaug; Speakers, Robert A. Tinkham, Arye Perlberg, Richard Nelson; Host, Robert G. Hostetter.

IMPROVING STUDENT TEACHING WITH TAPES AND TECHNIQUES

Richard Nelson
Arye Perlberg
Robert A. Tinkham

Oh wad some power the giftie gie us
To see oursels as others see us!
It wad from monie a blunder free us
—Robert Burns

In this day of scientific and technological miracles, it is still good to listen to the voices of the past – particularly when they express truths such as one found in the quote from Robert Burns. These lines should be especially meaningful to teachers whose success, in large measure, rests on their ability to use their thoughts, their appearance, their actions, and their voices to influence young people so that learning takes place.

As you have undoubtedly noticed, we have with us the two sets of equipment that are

used in the project. This afternoon we plan to use this equipment to show you tapes of two of our current student teachers and one experienced teacher to illustrate some points regarding the work of the project.

In view of the fact that, thanks to video-tape recordings, we can see ourselves as others see us, this advantage can be coupled very well with some of the promising developments in educational research such as micro-teaching (a short lesson presented to a small group of learners) and interaction analysis. When this is done, there is good reason to believe that better teaching will result regardless of whether the combination is used by prospective teachers or by those who are already in the profession.

It was this potential that led Dr. Arye Perlberg, a visiting staff member at the University of Illinois, to recommend a pilot study of the feasibility of using portable video-tape equipment to record the work of student teachers using micro-teaching techniques in the schools to which they were assigned. This would be done after they had been exposed to the concepts of micro-teaching in their methods class that precedes student teaching.

As approved for funding by the Research Coordinating Unit of the Illinois State Board of Vocational Education and Rehabilitation in October, 1967, the one-year exploratory study was expanded to include not only an investigation of student teaching in industrial education, home economics, and agricultural education, but also an in-service training program was planned for junior colleges and area vocational centers.

As part of their orientation to micro-teaching, student teachers, prior to going to their assigned schools, presented five lessons which were taped for critiquing by micro-teaching specialists. Likewise, they and their cooperating teachers were instructed in the operation of the equipment since it would be their responsibility to set it up and do the taping when the set arrived at their school.

To facilitate the full use of the equipment and to avoid some of the problems experienced by others who have attempted to incorporate video taping in a program, three additional steps were taken. These are strongly recommended in view of their value in the total operation of this program. First, housing units were designed and constructed to make each set a self-contained piece of equipment, one set in a mobile unit on casters and the second in a suitcase-like carrying case. Secondly, all electrical connections were made near foolproof by color coding. Finally, illustrated instruction sheets were prepared, tested, revised and brought to the point where quality taping was guaranteed if they were followed, step by step.

In each of the student teaching situations, a set of video-tape equipment was brought twice to the school and left for several days for use by the cooperating teacher and student teacher. During each appearance of the equipment the university supervisor would make one of his regular calls and would use a tape made while he was there to critique the lesson presented by the student teacher.

Because of the limited amount of time that the university supervisor has with each student teacher (calls of one-half day duration during the seven weeks of student teaching), a plan was devised by which additional tapes would be made and sent to the supervisor for his viewing and suggestions. This system was further refined by arranging a "conference telephone" discussion regarding a tape sent in by the student teacher. At the university the supervisor watched the tape with the sound being picked up by the telephone. Miles away the student teacher and cooperating teacher heard the tape and the supervisor's comments. This, in effect, was an excellent supplement to his regular supervisory calls.

As to the findings, it can be said that much was learned that will prove valuable in the future work of the project staff. In general, the project was well received by student teachers, cooperating teachers, students, the schools as a whole, and university supervisors as well. Certainly this type of activity requires a great deal of planning. The two sets of equipment travelled by car or station wagon a total of 4,200 miles in moving between the university and fifteen different schools.

During the first semester, the major problems were of a technical and a logistic nature. This was due to the fact that an attempt was made to tape all student teachers in industrial education plus two in agriculture education and one in home economics education. This proved to be too large an assignment and the second semester saw a reduction to eight student teachers in the three areas. With this curtailment, it was possible to conduct a more satisfactory program of tape-reviewing and critiquing. The total number of student teachers taped in the field for the entire school year was twenty-five. Their overall reactions indicate that they feel that the addition of micro-teaching techniques and video-tape recordings in a student teaching program is well worthwhile.

In closing, mention should be made of the fact that a follow-up study is being prepared. This investigation would be aimed at a comparison of traditional student teaching procedures and the newer method incorporating video-taping and micro-teaching techniques.

Messrs. Tinkham, Perlberg and Nelson are affiliated with the University of Illinois, Urbana.

W-7.5 AIAA
Special Interest Session
INDUSTRIAL ARTS AND VOCATIONAL REHABILITATION
Chm., Ervin Dennis; Recs., Charles Martin, Ronald Van Rooyan; Speakers, Walter J. Devins, Paul R. Hoffman, Daniel Mauchline; Host, Eugene B. Balzer.

VOCATIONAL REHABILITATION TODAY

Walter J. Devins

Vocational rehabilitation, since its inception in 1920 as a service function of government, has had a long and continued association with vocational education. The original law establishing programs of this type designated the state board of vocational education ... ble state department for administration, and currently 75% of all nation- rehabilitation agencies have this administrative status.

... rehabilitation, in its simplest terms, is the process of developing an in- ...apacity to function at his highe... potential despite his handicap within his ...ent. At this time, let me state that this process involves all aspects of the individual's capacity to function in society, and this is by no means limited to the physical. It has long been recognized that the emotional, social and vocational adjustments of the individual are so interwoven that each must be evaluated and developed when working with the disabled individual.

Significant these days has been the trend toward constructive use of leisure time. For a while, we were mostly concerned with the vocational and the social adjustment required in the work setting, while today we are vitally interested in the use of leisure. Recreation, therefore, has been added as another component to the rehabilitation process.

Most authorities consider the World War I period as the start of rehabilitation, although there is sufficient evidence of efforts of this type that date back to the dawn of recorded history.

For practical reasons, however, World War I is used as the base for the start of the federal/state vocational rehabilitation program that has increased in authority and scope at various intervals over the years, namely 1943, 1954 and 1965. Each of these years represents significant periods when legislation expanded the services available for the handicapped. Like several of the other federally-oriented social programs, these are cooperative federal/state endeavors where the state can match federal funds within a framework to provide services. This is sometimes referred to as "creative Federalism" and state programs vary depending upon the commitment of each jurisdiction.

Since 1965, the Rehabilitation Services Administration has embarked upon several new grant programs to improve rehabilitation facilities, based upon the premise that services are only available when there are sufficient facilities in which to provide these highly specialized services to various clients. Paramount in this program has been the development of two state plans: (a) The Comprehensive Plan that analyzes needs for services by the state and (b) State Plan for Facilities and Workshops.

The latter has established priorities for improving or constructing new facilities. To date, 17 workshops, 3 comprehensive centers and one comprehensive speech and hearing center are in the process of construction. More than 250 individual improvement grants have provided 450 new staff positions and equipment ranging from hand tools through industrial type machinery appropriate to sustain production.

Today we see several new trends emerging in rehabilitation facilities, such as the development of industrial job sites as an extension of the evaluation process. Perhaps a

good example is the case of nurses' aides training that simply cannot be simulated like production lines are with subcontracts. There is no substitute for the nursing home or hospital for training of this type. Industrial job sites within the structure of the industry itself are now in the forefront and vary as much as all workshops and localities do. Within the foreseeable future, rehabilitation facilities are expected to become a familiar part of an industrial complex.

One of the outstanding examples of this is in Mississippi. This state is in the process of acquiring an industrial economy to substitute for the former agrarian activity that is now on a decline as the sole occupational base. In response to this, the state has a regional development program that not only attracts but selects on the basis of providing a diversity of types of industry, which will be promoted or given a priority for an area. This has carried over into the rehabilitation picture by locating facilities in emerging industrial parks. About a year ago, in a field survey, I visited several in the state that all met this criterion, especially one in Kosciusko, Mississippi. This is a modern one-story building that resembles the newer elementary schools so prevalent throughout the country today. With an open building of this type, there are many options for change within the structure because of the absence of permanent partitions. The production work in this facility is identical with that of two adjacent industrial plants with the same processes and machinery. Due to this close identity, clients gradually trained in specific skills with industrial standards of performance, prior to transfer into the main plant.

In other parts of the nation, South Carolina for instance, they are developing rehabilitation programs for correctional institutions that have supportive counseling as a built-in feature, and this is carried back into the community under the same counselor when prisoners are released. Throughout the country, several similar projects are either in the developmental phase or functioning at this time, with the unique approach of maintaining community ties during the sentence-serving period. Several of these clients have been successfully reintegrated into society with meaningful socially acceptable goals and behavior patterns, that have been developed by applying the rehabilitation process within the structure of the penal system.

Another largely neglected group of citizens in this country has been the disabled migrant workers, who without identity with a specific community were unable to secure required medical and vocational services, but are today eligible under new projects in such states as Texas, California and Washington, as well as New Jersey and New York, which also have seasonal workers.

More and more as we observe the development of facilities, both the medically oriented and those of a vocational nature commonly known as workshops, we recognize the need for reinforcing programs of this type with professionally trained and competent personnel. Approximately 60% of all workshop improvement grants are for partial salary support of such staff as work evaluators, vocational instructors, social workers and psychologists.

Recently, a set of standards has been developed and adopted by the National Policy and Performance Council that covers the essential areas of an operating rehabilitation program. These standards were developed by a panel representative of the community at large with members from business, labor, voluntary rehabilitation agencies and professional groups. Perhaps of interest to this group are the qualifications of a work evaluator that requires an MA in an appropriate field and one year of experience in rehabilitation or other suitable experience.

An undergraduate degree and three years' experience in industrial arts education or rehabilitation counseling are also acceptable as qualifications for this position.

These standards at present are objectives for our workshop improvement grants and must be substantially met by all applicants involved in the training services grant program. During this past year, more than 1,200 clients, receiving financial support up to $65 per week, were trained in skills ranging from custodial work to specialized electronic procedures through this grant program.

Today cooperative programs between vocational rehabilitation and special education are more the rule than the exception throughout the country, insuring early and permanent adjustments to our industrial society.

Some of the more remote handicapped groups that are being reached with rehabilitation techniques today are the narcotics addicts, welfare recipients and others. Currently, the Federation of the Handicapped in New York is developing a planned program of services for those addicted to narcotics as a component of the "Methadone" project.

Research and Demonstration grants of $65.5 million support a number of projects

improving medical rehabilitation services such as physical medicine, prosthetic and orthopedic applications. Interestingly, close coordination with the National Aeronautics and Space Administration has produced meaningful results, for example, the adaptation of lunar excursion module ambulatory movement to wheelchairs.

Training of professional rehabilitation personnel such as counselors, work evaluators, social workers, occupational therapists and others represents 33 million or one half of the total Research and Demonstration budget. The greater portion of these grants is awarded to individuals pursuing graduate degrees in health professions.

As a government agency, Rehabilitation Services Administration is dependent upon legislative authority for any expansion of services to the handicapped. Fortunately, in a democracy such as ours, the legislative system is a dynamic process continually responding to the needs of the public by providing the means to cope with the problems of the individual citizen. Even at this time, expanded authority is being developed in Congress that will provide new approaches to assist in rehabilitating the handicapped throughout the nation.

Mr. Devins is Consultant with the Division of Rehabilitation, Rehabilitation Services Administration, Washington, DC.

INDUSTRIAL ARTS AND EVALUATION OF THE HANDICAPPED

Paul R. Hoffman

Evaluation of abilities, aptitudes, interests and personality factors has been the focus of psychological testing. Although psychological testing has progressed to a good degree of sophistication, it has not been able to meet fully all the needs in evaluating the handicapped. Many of the handicapped seen in vocational rehabilitation facilities are persons for whom sufficient data cannot be collected by means of psychological tests. [illegible] are individuals who do not have the educational attainment to take [illegible]gical tests, who lack the cultural background which orients them to [illegible], who have had negative experiences with such tests, who are too anxious to perform adequately in a psychological test situation, or who suffer from some other factor that prevents adequate measurement on standardized psychological tests.

A different method of evaluation had to be found. The different method which has developed is that which utilizes work or an aspect of work as the basic tool for evaluation. This has come to be known as work evaluation, of which there are two basic methods. These two methods of evaluation are work samples and actual jobs.

A work sample is a component of work which serves to measure a particular trait or ability to do a particular job or a series of jobs. Work samples may be devised by conducting an analysis of a job and devising a test, or work sample, to measure one or more components of the job. A work sample may be one aspect of a job, such as soldering wire on an electronic component, or it may be a task not related to a particular job, but devised to measure a particular trait related to a number of jobs, such as fine finger dexterity. Work samples may be developed by setting up a particular job in isolation of the industrial or business setting. With the job setup in isolation, the client performs a set number of operations rather than working day in and day out on the job.

There will be work samples pertaining to electronics, electrical wiring, mechanical assembly, drafting, welding, machine shop, lettering, automotive mechanics, wood working and wood refinishing, as well as in other vocational fields such as clerical, sewing machine operation, laundry operations and homemaking. The knowledge of the industrial arts person is, of course, directly applicable to the work samples first mentioned, although industrial arts persons entering the field often learn to evaluate handicapped persons utilizing work samples in other areas. The contribution industrial arts persons can make in this field is not only their ability to utilize the work samples, but to develop effective work samples based upon their knowledge and skills.

The second method of work evaluation is the utilization of actual jobs. This job may be within a sheltered workshop, an institution or hospital, or placement in an industry or

a business. In a sheltered workshop, a client can be placed on a production line or on some other job within the workshop. In an institution or hospital, he can be evaluated by placement in the food service, custodial service, laundry or other department. It should be noted that the client is not evaluated on one job, but usually on a series of jobs. As indicated, a client can also be placed in industry or business; however, this type of evaluation is usually reserved for those with potential for success either initially or after training and personal adjustment.

The sheltered workshop is the principal facility utilizing jobs within its setting as the means of evaluating the handicapped. For those who are not familiar with a sheltered workshop, it is a facility that, either through subcontracts, renovation, production of its own product (or a combination of these), offers a controlled work environment for the handicapped. It utilizes work experience and related services to assist the handicapped to become productive and live rewarding lives. It may also offer extended employment under controlled conditions to the more severely handicapped who cannot enter the competitive employment market. The knowledge and skills of the industrial arts person are applicable to the needs and functions of the sheltered workshop.

The basic objective of the work evaluator is vocational diagnosis and prescription. He must evaluate dexterities, skills, attainments, work habits, work tolerance, ability to learn a job or potential for becoming employable, and to assess social and behavior patterns relative to the client's becoming economically self-sustaining. He makes a vocational diagnosis, and if the person has the potential for directly entering into a job or job training, then this becomes the recommendation or prescription. If the handicapped person will first require adjustment of behavior, increase in work tolerance, basic education or some other factor to make him ready for employment or job training, then this becomes the prescription.

From the foregoing, it should be clear that industrial arts as a professional field and industrial arts personnel have much to contribute to the field of work evaluation. The training of the industrial arts personnel in basic areas such as electronics, woodworking, machine shop, etc., provides him with the skills to utilize many of the work evaluative tasks and to develop effective work samples. The skills developed in teaching and evaluating students during industrial arts training are also directly applicable to the field of work evaluation, as are many of the other courses included in industrial education. Today there are many industrial arts personnel in this field. Because of the shortage of training programs, industrial art students are entering the field directly from undergraduate school.

There is, however, a need for additional knowledge on the part of the industrial arts person entering the vocation of work evaluation. There is a need to learn about medical and psychological aspects of disability, occupational information as pertinent to this type of clientele, job analysis, techniques of work sample development, theory and techniques of work evaluation beyond the general application of their knowledge from industrial arts, supervisory practices in evaluation, and other information pertinent to the field. Up until recently there have been only six-week programs training work evaluators, but this year a graduate program in work evaluation was begun at Stout State University.

The opportunities in the field of vocational rehabilitation and work evaluation are excellent. Programs of work evaluation exist in or are being set up in rehabilitation centers, sheltered workshops, high schools, hospitals, institutions for the retarded, prisons, youthful offender camps and facilities for the alcoholic and narcotics addict. There is currently an extensive need for experienced and inexperienced work evaluators. The need will radically increase due to the increasing number of programs. Legislation now pending in Congress will greatly increase the programs in work evaluation which, of course, will increase the opportunities. Salaries in the field are comparable to other professional opportunities requiring comparable professional training. One of the big advantages is the opportunity to enter a field in its relatively early stages and contribute to its growth, to experiment and to chart new ground.

Last, but most important, the field of vocational rehabilitation offers all who would enter it the opportunity to assist less fortunate persons to lead a fuller life, or to assist persons to a life that for the very first time holds promise.

Dr. Hoffman is Director of Vocational Rehabilitation Programs at Stout State University, Menomonie, Wisconsin.

SHELTERED WORKSHOPS AND INDUSTRIAL ARTS

Daniel D. Mauchline

At the present time, there are about 1,100 sheltered workshops in the United States, serving about 55,000 client/employees, with total annual sales of industrial goods and services of approximately 55 million dollars. This is a small industry compared to GM or IBM, but its growth has been unusually rapid over the last decade and the outlook for future growth is extremely promising.

As vocational rehabilitation offers services to a client population with wider and wider ranges of disabilities, workshop services will become increasingly necessary. Not long ago, it was considered as acceptable procedure for a rehabilitation counselor to regard an amputee as the ideal sort of client because of the simplicity of rehabilitating him, while the counselor would avoid mental retardates or post-psychotics because of the myriad complications and the lengthy period of time involved in moving the individual along toward rehabilitation. Today, we have a large number of rehabilitation counselors whose entire case load consists of mental retardates or post-psychotics, and the counselor who seeks out only patients with simple, uncomplicated orthopedic disabilities is regarded by his peers as possessing questionable competency.

This "new breed" of rehabilitation counselor, who is willing to assault problems which would have terrorized his ancestors, requires a range of community services which is wider, more complex and rather more difficult to evaluate than were the services previously required. A recent survey of rehabilitation counselors in Maryland revealed that counselors regarded psycho-social services as the most critically needed, and the most poorly distributed. Counselors felt that medical services were generally adequate for their purposes, but vocational evaluation services and personal adjustment training, while badly needed, tended not to be available outside of metropolitan areas. Additionally, general dissatisfaction with the quality of sheltered workshop services (especially vocational evaluation and personal adjustment training) was expressed.

The Maryland Workshop and Rehabilitation Facilities Study Committee, in commenting on these survey results, pointed out that while there was a real need for additional sheltered workshops in the state, the most serious problem at hand was finding adequately trained staff members for the shops. It is easy to get a physical plant built and equipped, but without competent personnel to run the programs, the physical plant becomes a white elephant. The workshops already in operation are relatively poorly staffed and their industrial operations are primitive and unsophisticated, so that the work experiences provided to clients are minimally realistic.

It would appear that a workshop which could successfully blend the competencies of those trained in psychology and counseling with the competencies of those trained in industrial arts would be well along the road to becoming a social agency oriented toward effecting behavioral changes in its clientele, through the provision of counseling in a highly realistic vocational environment. This means that the physical plant must be reasonably contemporary – it must be adequately lighted and ventilated; it must be in a state of good repair; it must have equipment similar to that encountered in modern industry; it must observe reasonable safety practices; housekeeping practices must be good. These aspects of the physical plant are probably better dealt with by individuals trained in industrial arts than by individuals trained in psychology, counseling, or guidance, since the psychologically oriented tend to relegate the physical environment to a secondary role. Another benefit brought to the workshop by the individual trained in industrial arts is the ability to work with things, to use equipment well and economically; to build simple fixtures and holding devices as necessary; to simplify work flow and work tasks. In short, the sheltered workshop must have those who are interested in the psychology of the individual and those who are interested in the individual's environment if it is to accomplish its chores in efficacious fashion.

While there are several universities offering training in sheltered workshop operations, it is unlikely that the programs presently in existence or those planned for the immediate future will be able to meet the demand for personnel. The National Association for Sheltered Workshops and Homebound Programs surveyed its membership late in 1967, asking a number of questions about the operations of the shops which belong to the organ-

ization. One of the questions asked was how many staff members would be needed by each shop over the next three years. The answers indicated that an average of one staff member per shop per year would be needed over the next three years. This amounts to a total of 3,300 staff members to be found by 1971, even if no new workshops are started in the next three years. If all graduates of all university training programs for rehabilitation counselors and sheltered workshop administrators and supervisors went into sheltered workshops, there would still be a large number of unfilled positions.

It would appear that industrial arts graduates who are interested in rehabilitation and who are willing to make an aggressive and positive presentation of their abilities to sheltered workshop administrators have an entirely new field of activity awaiting them.

Mr. Mauchline is Research Director with the University of Maryland, College Park.

W-7.6 AIASA
AIASA Session
THE HIGH SCHOOL INDUSTRIAL AR CLUB IN ACTION
Chm., Donald Parker; Rec., Sherry H ton; Speakers, Rudy Cantu, Jerry Howard, Don Townsend, Sam Ewalt; Hosts, William Faver, Billy Mayes.

INDUSTRIAL ARTS AND CLUB WORK

Rudy Robert Cantu

Society is a complex machine. Each of its individual parts is necessary for the function of the whole. If one of these fails to operate efficiently, the entire system is crippled.

The key to success is education. Although many students find it advantageous to devote their efforts to one particular field of study, there are more job opportunities open to the student with a broader education.

There are many subjects available to the student pursuing a general education which are of equal benefit. Included in the list with mathematics, sciences, languages and social studies are courses in industrial arts. A student seeking a general education should take a major part of the electives of his curriculum of study in industrial arts.

Ours is a technical society revolving around industry and manufacturing. As industry grows, the demand for industrial arts majors also increases. Today's world is constantly progressing, and revolutionary changes will become apparent in the future. These trends will be toward more scientific, mechanical and technical modes of life, therefore magnifying the significance of a basic knowledge of the principles of industry.

The field of industrial arts consists of many different areas. Any of these fields may lead to a career and a vocation, or broaden one's general education.

One of these is the field of drafting. Most courses in drafting consist of three main levels: mechanical drawing, architectural drafting and industrial drafting. A student seeking only a general knowledge of drafting, can take basic mechanical drawing. However, one who wishes to further his study of drafting may choose either architectural drafting or industrial drafting. A working understanding of architecture is the initial step on the long road to obtaining one's goal. Even if your study does not lead to a career, it may still prove to be extremely beneficial in helping a young housewife design her dream kitchen or an elderly businessman create his castle.

The other branch, industrial drafting, is primarily for the student wishing to become a professional draftsman. However, any student who completes one or all of these courses should find his education and life enriched by the qualities of pride in his work, advanced creative ability, neatness and the spirit of competition.

If drafting is not the course he wishes to follow, the student may choose to study woodworking, automotive mechanics or data processing. Although differing in curriculum, the study of each of these vocational fields should result in obtaining the same qualities.

Although a career in industrial arts may not be the goal of each student in the course, one cannot help but be affected by the knowledge gained. For education is knowledge, and

knowledge is success: success in a world where those with a sound general education will prosper.

Mr. Cantu is President of AIASA.

W-7.7 AIAA
Special Interest Session
SAFETY IN EDUCATION
Chm., Joe Luke; Rec., Al Sherick; Speakers, Alan R. Suess, Stanley Sweet, Edgar Hare; Host, Albert G. Mudgett.

SAFETY INSTRUCTION AND TEACHER EDUCATION INSTITUTIONS

Alan R. Suess

About a week after the death of a Minnesota North Stars hockey player in January, Arthur Daley of the New York Times News Service wrote of the reluctance of the hockey players and management to use protective head gear. The following excerpt is representative of the tone of the entire article:

"A little more than a week ago Bill Masterton of the Minnesota North Stars became the first fatality in 51 years of big league [illegible] his head crashed to the ice after what was described [illegible] a routi[illegible]ck. Although it undoubtedly [illegible] accident of once-in-a lifetime dimensions, it still abruptly [illegible] the [illegible] of a fine young man. A helmet undoubtedly would have saved him.

Yet there is no disposition on the part of hockey authorities to encase the noggins of their stick-wielding mercenaries in protective headgear. They were shocked by Masterton's death and properly sympathetic to his young widow and two small children.

But the members of the establishment had survived the ha[illegible] of this fastest of sports during their playing days and all have a built-in preference for the status quo. They developed a distaste for helmets as players and now that they've moved into the executive branch, they still are resistant to them, the tragic warning of Masterton's death to the contrary."

Tragically, it would be possible to substitute the terms "industrial arts teacher educators" for "hockey authorities" and "laboratory safety practices" for "protective helmets" and the article could have been written about contemporary conditions in industrial arts. Your speaker is fully aware of the danger of gross generalizations and also aware of outstanding exceptions to the thesis of this paper. Nevertheless, industrial arts and particularly industrial arts teacher educators face important decisions regarding implementation of appropriate safety measures in the schools and concomitant preparation of prospective teachers in the realm of safety.

The scope of the problem facing industrial arts teacher educators is brought into dramatic focus by recent advancements in legislation regarding mandatory eye safety in the schools. Ohio was the first state to enact mandatory eye safety legislation in 1963. Since I was a teacher educator in Ohio at that time, let me add parenthetically that leadership for the law was provided by vocational education and science groups. According to the National Society for the Prevention of Blindness, Inc., a total of twenty-six states had enacted mandatory eye safety legislation as of April 15, 1968. The State of Kentucky law lacks only the Governor's signature and the Louisiana State Department of Education has issued regulations based on the model eye safety law which unconfirmed rumors indicate will soon become state law. The National Society for the Prevention of Blindness, Inc., statisticians also report that more than 70% of the nation's students reside in the twenty-six states with eye safety legislation.

The excuse that eye safety instruction and mandatory use of safety glasses in teacher education programs are not needed because there is no legislation in the state loses whatever tenuous verity it previously held when one looks at teacher mobility. Yet, if you were to walk unannounced into many teacher education laboratories, you would observe students with bare eyeballs squinting through a cloud of sawdust or pouring a casting just as it was done in the good old days. The establishment has not yet deemed it necessary to change since they have never had any accidents (or have repressed those that have occurred), and besides those darned glasses just get in the way. More pathetic than the successful blocking of adequate eye protection by a few faculty members is the unilateral decision by the department head who, in order to justify his opposition, blocks adoption of an eye protection program because it interferes with an individual's "right" to self-determination. This argument carried to its logical conclusion would make it necessary to remove all traffic regulations because someone in the society may want to drive 70 miles per hour through a residential district.

Recent emphasis on eye safety legislation has brought this topic into focus. Although eye accidents are dramatic and their consequences are usually long-term, the accident rate of less serious injuries in the industrial arts programs of the nation may do more to bring disfavor to our programs than all the criticism and questioning of our content, methods, goals and total effectiveness.

Comprehensive data regarding the accident rate in industrial arts are almost impossible to collect. The data that do exist, however, assume frightening proportions when extrapolations are made to the national scene. One of our graduate students is current surveying the accident rate in the industrial arts departments of the State of Indiana. Although the results are not yet complete, partial returns from only forty-five schools indicate that last year there were 20 accidents requiring medical attention. If we had an unbiased sample and unchanged conditions (which, of course, is not the case), three hundred and fourteen Indiana students will require either the care of a physician or hospitalization this year as a direct result of being enrolled in industrial arts. Since Indiana, with five million population, comprises about two and one-half percent of the national population, the magnitude of the accident rate takes on even greater importance.

The role of the teacher educator in the reduction of the accident rate among industrial arts students is at least two-fold. First, improved safety instruction and practice during the teacher education program is imperative. I can take you to a metalworking laboratory in a teacher education department where you could hear a well-prepared lecture and demonstration of the safe use of the squaring sheer. The demonstration would include a discussion of how an undergraduate recently lost the tip of his finger and how safe operation will prevent such an incident from recurring. The only problem is that the instructor has never taken the hour required to tap three holes in the hold-down fingers and install a plastic guard to protect the user.

The second, and equally important, function of the teacher educator in accident reduction is to assume leadership by taking a long hard look at the activities occurring in contemporary industrial arts. The educational relevance of many of the more hazardous practices in industrial arts classes is highly questionable. The recent rash of serious accidents, including at least one fatality, resulting from face-plate turning on a wood lathe is a case in point. Are the outcomes from turning a bowl justifiable in terms of the staged objectives of the course? Similarly, are the gains from providing instruction in the use of the wood shaper worth the number of fingers injured and the resultant permanent impairment of our students?

The meager gains of safety officials in convincing the general public of the benefits of auto seat belts dramatize the scope of the problem for both classroom teachers and teacher educators in the development of a meaningful safety program. Nevertheless, the moral, economic and professional implications of inaction are so great that the entire profession must unite to reduce the hazards to the youth in our care.

Dr. Suess is Associate Professor at Purdue University, Lafayette, Indiana.

W-7.8 AIAA
Special Interest Session
FEDERAL AID TO INDUSTRIAL ARTS
Chm., Earl Weber; Rec., Milo N. Sulentic; Speaker, Paul Manchak; Hosts, Elden Brandt, Otto E. Ursin.

TITLE XI, E.P.D.A. AND INDUSTRIAL ARTS

Paul J. Manchak

Industrial Arts continues to be a member of the Federal family. While at a slower pace than some would like and while sometimes flying under banners not easily recognizable by old line definitions, industrial arts curriculum reform, spurred on by the availability of Federal funds, continues to progress at an ever accelerating rate. Support includes funds to help equip and remodel laboratories and classrooms; and the subsidization of innovative programs and programs for the disadvantaged. Other programs assist states in expanding and improving their supervisory and related services. Still others such as NDEA Title XI, HEA Title V-C, and their successor EPDA provide fellowships, institutes and other training programs for educational personnel.

Through the summer of 1968, approximately 3.4 million dollars of Federal funds will have been spent for institutes and fellowships for study in industrial arts.

The effect of these training programs, which provide annually for less than two percent of the country's industrial arts school personnel, cannot be measured by the number of individuals they have served or by the number of institutes they have supported – nor by the number of institutes in any one state. Rather, such a program can be considered only in terms of its national influence on the teachers trained and the children who in turn are trained by them.

Institutes have helped to spark a renewed interest – a renewed national interest – in the preparation of elementary and secondary school teachers. Today, there is greater attention to this problem on every academic level. The improvement of teachers, through pre-service and in-service training, cooperation between the university and the school, and communication between the school and its community, including industry, are all evidence of a new movement.

It is already evident that there is more to Federal aid than Federal funds. There are many unexpected and unplanned dividends which accrue from the original investment. In short, we have learned that the funds themselves may be of less consequence than the opportunity to allocate them. For Federal assistance, broadly viewed, has commenced a powerful dialogue on education that is national in scope, not parochial, and one that is contemporary in approach, not academic.

With the beginning of EPDA on July 1, 1968, and a new Bureau of Educational Personnel Development, the business of Federal aid to education shifts into second gear. It will not be a brand new enterprise, inexperienced and wary, but a venture which can move forward with confidence and experience.

Legislatively speaking, it should be noted that the Education Professions Development Act represents a distinct change. For it is a move from limited categorical aid to a broader form of categorical aid, one that is more concerned with the general problem of manpower and teacher training than with specific teachers or certain disciplines.

The EPDA is the logical successor to NDEA. It is a sophisticated piece of legislation that goes to the heart of the matter: the education of teachers and related personnel. Prior to this legislation few basic changes were made in the original NDEA authorization for training. Additional subject fields were authorized in 1964 and 1965, and greater attention was given to the activities of a wider variety of educational personnel. Nevertheless, many gaps remained. In particular, no provisions had been made for a wide variety of individuals who serve education, such as non-professionals and school administrators.

Essentially what the EPDA does is to open up the field for the training of almost anyone who serves education, professional or non-professional. Now the Office of Education will be able to support programs to train teacher aides and the variety of specialists and supervisors who provide leadership for the schools, including administrators in elementary and secondary education, as well as in the colleges. It also allows the Office to make grants to local school districts and to State Departments of Education. And it permits a vastly greater use of imagination and program flexibility in the kinds of projects which can be supported.

The most pertinent parts of EPDA of interest to this group include: Part B-1 which continues the Teacher Corps; the second part of Section B is new providing for grants to states which enable them to support efforts by local educational agencies to attract individuals to teaching and also to provide them with necessary training. Funds under this part may also be used to obtain the services of teacher aides and to provide them the

essential training that they will need.

Part C continues the Teacher Fellowship Program originally authorized in 1965. In the future this tri-partite program – Experienced and Prospective Teacher Fellowships and Institutional Assistance Grants – will be administered as a single entity. The inter-relationship of pre-service and in-service, advanced study leading to certificates, an MA, even the PhD, may now be emphasized, rather than treating each separately, isolated from developing programs. Developmental grants may also be made to enable colleges and universities to strengthen graduate programs for the preparation, and re-training, of educational personnel.

The institute program is continued by Part D, but without the previous limitations of thirteen separate categories. All subjects usually taught in the schools are now eligible for support. This does not, however, alter the continuation of the institute programs in each of those thirteen categories previously funded under NDEA, and they will be supported at least to the 1967-68 level.

While national priorities will be established by the Commissioner – such as emphasis on projects for the disadvantaged or programs in early elementary education – proposers may identify their own priorities for training educational personnel, submitting proposals which meet their own needs. The major goal is to seek out programs of highest quality and to increase the number as well as to improve the qualifications, of educational personnel available to the nation's schools.

Generally, proposers under the new guidelines are encouraged to use the university's total resources, combined with the resources of the schools themselves, in the training of teachers. We expect the schools to help take the lead in training school teachers, in tandem with the colleges and universities. Too long has the teacher continued to go to college while the professor remained on campus aloof from the school. We expect to have proposals from institutions of higher education or from the schools which provide for a joint effort and which are conducted in genuine collaboration.

Finally, we hope that proposals will be submitted which attempt to use other sources of Federal funds, particularly those from Titles I and III of ESEA, in order to augment the support available under EPDA. Thus a joint proposal might provide for an in-service program in which training is given by a college, supported under EPDA, while a cooperating local education agency could supplement the total cost of the training enterprise under Title III.

May I conclude with the assurance that the Office is not on another innovation kick. While we hope that most of the proposals will point to better and probably newer ways of training educational personnel, the guidelines do not preclude consideration of proposals based on a program already in operation since it also may well be of high quality and innovative to boot.

Dr. Manchak is a Specialist for Industrial Arts with the US Office of Education, Washington, DC.

Th-10.1 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO TEACHER EDUCATION
Chm., Alvin Thomas; Rec., Neal Prichard; Speakers, Donald G. Lux, David L. Jelden; Host, Claudius Wilken.

LEARNER CONTROLLED EDUCATION

David L. Jelden

Industrial-technical education is faced with the problem of keeping course content and methods current with changes in industry. Essentially, there are two problems rather than one. The first is to keep the content of the course current with the changes that are occurring in business and industry. The second is to develop educational methods that will allow for effective and efficient learning of the content. This second problem is of special concern in providing for retraining or upgrading of persons who are working in business and industry. This proposed project is directed at the second problem, that is, the method of instruction.

The basic argument of this proposed project is that an individualized method of instruction will provide for the flexibility that is needed in industrial-technical education. The rapidity of change is making it increasingly difficult for curricula to remain current within the framework of the formal classroom methods that are now commonly used. Further, even if classroom procedures could become more flexible, this method is not amenable to providing for individual retraining and upgrading needs. If man can be taught to teach himself and make use of available resources to attain the needed knowledge and skills, then the retraining and upgrading problem can be achieved through individual study.

The solution is not all this simple, however. That man can teach himself is self-evident; however, that man is naturally an efficient and effective learner in a self-instructional situation. The success of study skills experiments (vide Shaw, 1955; Brown and Holtzman, 1955) is testimony to the contention that man's skill at learning can be improved. Further, the phenomenon of "learning how to learn" that has been postulated by Harlow (1949) also suggests that man learns this ability, and if it is learned, then the degree of this learning in any person would be at some point on a continuum from low to high. Gage (1964) has suggested that learning procedures are not general for all learning outcomes. Learning strategies may differ in efficiency and effectiveness depending upon whether the outcomes differ in terms such as being cognitive, psychomotor, and affective. This implies, then, that man should be taught or should learn those strategies that are effective or relevant to the learning outcomes involved in a particular learning task.

Even if man can be taught to teach himself, then there is the problem of his having sufficient resources available for learning what is needed. One of the primary tasks of the educator or teacher in the individualized method would be to know what resources are needed for any learning task and to make these resources readily available to the learner. The efficacy of the provision of a variety of resources and learning materials has been demonstrated for young children. Nimnicht and Meier (1966) reported on a "responsive environment nursery school" in which one of the essential features is the provision of an "enriched social, vital world" with which the child can interact. Moore (1964) and Deutsch (1963) have reported similar results with young children in enriched settings.

The "responsive environment" in a nursery school is essentially an environment in which a wide variety of resources are avilable for the young learner. The provided variety is not, however, just a random collection of things but rather is a collection of materials in which each component has some purpose.

Although the "responsive environment" procedure has been demonstrated only with young children, it seems reasonable to expect that the same type of situation would operate effectively with other age groups. An adult who is more capable of independent effort than a child should be capable of operating even more effectively in an appropriate "responsive environment" than the young child.

Thus, in a course such as electricity-electronics, if the adult student knows the knowl-

edges and skills he will be expected to attain at the end of the course, if he knows the learning strategies that can be effective for him in attaining these ends, and if adequate resources were effective for him in attaining these ends, and if adequate resources are provided, then the student should be able to be self-directive in his study and control his own learning. Further, the learning should be attained more quickly and be more meaningful to the student than it is in the traditional classroom situation. The basis for this expectation is that self-directed learning is generally more motivating and the enriched environment of the wide variety of resources will allow for more desirable attitudes (vide Neidt, 1964) toward the material. Also, it will allow for a more generalized understanding of the learning because of the opportunity to practice and deal with the concepts in a variety of situations (vide Duncan, 1958).

The following statements, then, are the basic assumptions for the proposed project:

(1) It will be improbable and perhaps impossible to keep our schools up to date in a dynamic technological society.
(2) The development of learning skills is as important to teach as the subject matter itself. Both can be taught simultaneously under a well structured system.
(3) It is unnecessary to send people back to school in a formal atmosphere for updating as often as some educators might think. If the student is properly motivated, self-instruction is a reality.
(4) The student is capable of determining his own course of action when he is made aware of the possibilities that exist to find answers.
(5) A wide variety of resources must be available to the student for an effective individual learning situation. These resources will be available through many media.
(6) Each student knows or will learn what his strengths and weaknesses are as they relate to how he learns best.
(7) When an objective is set by the student, its attainment is more personal, the motivation is stronger, and its achievement more rewarding.
(8) More material can be covered better in a shorter period of time. The student will get better, more meaningful learning.

The Learner-Controlled system of instruction to be developed for the course in electricity-electronics will exhibit the following characteristics:

(1) The content of the course and the goals of the course will be based on a determination of the knowledge and skills required for success in industry. This determination has been completed on the basis of studies by Brown (1960), Jelden (1960), and Coleman (1966).
(2) A wide variety of materials will be collected and/or developed for the course. The materials will be in the form of nine basic media: programmed texts and machines, reference books, slides, tapes, workbooks, films and video tapes, overhead transparencies, electrical-electronic equipment, and lecture demonstrations.
(3) The materials will be analyzed and cross referenced by topics. The Learning objectives will be isolated to provide information to students as to which resources are available for the various objectives of the course.
(4) The student will be instructed on the procedures of the course and will then work independently.
(5) Evaluation of student progress will be done individually. When the student believes he has attained an objective he will ask for an evaluation. Immediate feedback will be provided the student, and if the objective has not been reached additional study materials will be suggested.

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Dr. Jelden is Industrial Arts Chairman at Colorado State College, Greeley.

Th-10.2 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE SUPERVISION OF INDUSTRIAL ARTS

Chm., William C. Oleson; Rec., DeWitt B. Booth; Speakers, Chester W. Freed, Harry E. PaDelford; Host, Eugene Wood, Jr.

EDUCATIONAL INNOVATIONS— THE SUPERVISOR'S ROLE

Chester W. Freed

Basically, there are sixteen innovations affecting instruction today; one of this number has extreme potential for industrial arts instruction. It is the development of a taxonomy for industrial arts as proposed by Dr. Paul DeVore at the 1964 and 1967 conventions of this association. Technology has grown too fast and in too many directions for industrial arts to afford the luxury of not having an organized subject matter. Dr. DeVore has elaborated on the taxonomy; therefore, I will not repeat his presentation.

Leaving the taxonomy, the other fifteen innovations are:

(1) Instructional Objectives			
(2) Programmed Texts			
(3) Video Tape			
(4) Single Concept Films	Teachers		
(5) Study Carrels			
(6) Individually Prescribed Instruction (IPI)			
(7) Team Teaching			
(8) Modular Scheduling		Principals	
(9) Ungrading – Continuous Progress			
(10) Unstructured Student Time			
(11) Library Innovations			
(12) Large – Small Group Instruction			
(13) Para-Professionals			Administrators
(14) Computer Assisted Instruction (CAI)			
(15) Extended School Year			

These innovations can be separated into three groups: those that can be initiated (1) by teachers, (2) by principals and (3) by administrators.

Educational innovations are aimed at improving learning through individualizing instruction.

As instruction passes from the "performing teacher" toward programs designed to meet individual needs – whether these needs be designated by teachers, students, or a combination of teacher and student – the schoolhouse will also have to be altered.

Teaching spaces will have to be replaced with learning spaces. Quincy box-type rooms with the "audit-orium" philosophy must be transformed into spaces for learning activities.

Active learning through varied experiences has mandated that the physical facilities for the industrial arts program be designed to accommodate these activities. However, these same accommodating facilities can become a deterrent force relative to an evolving curriculum. The learning spaces for industrial arts, which are new this year, must be designed to accommodate not only the present program, but also the one which will be in use in the year 2000.

Preparatory to deciding which, if any, of these innovations will be implemented, one must give the entire scope of innovation a close study. Through this study, one must make value judgments about which innovations will assist the industrial arts program in achieving its goals or aims.

Proliferation of professional literature indicates that many new ideas are being tested. But rare is the supervisor who will claim to be keeping up with his reading. Awareness of innovations is a necessity if supervisors are to advise others about these innovations' implications for industrial arts.

If supervisors are going to become a positive force in keeping industrial arts in the mainstream of education, they must assist three groups of educators: (1) teachers, (2) principals and (3) administrators.

Assisting teachers in the task of individualizing instruction will be the main effort of the supervisor in his relationship to educational innovation. The first step toward individualizing instruction is that of planning. Too often we, as educators, have accepted some type of educational hardware as a temporary end in individualizing instruction. Hardware cannot supplant sound planning for instruction! Basic to this planning is development of instructional objectives in terms of terminal behavior. Developing these objectives is primary to both teacher planning and student learning.

Training oneself and others to think of educational objectives in terms of behavior is at best a difficult task. Mager's book, Preparing Instructional Objectives, and a set of filmstrips on educational objectives, which was produced by The University of California, can be utilized as a core for inservice programs on developing instructional objectives. Once these objectives have been developed for the entire class, then more individual objectives can be developed similar to those proposed by Bloom, et. al. – Levels of Cognition. These levels of cognition range from knowledge (the most simple level), through comprehension, application, analysis and synthesis to evaluation (the most sophisticated level).

Within the current structure of public education, developing instructional objectives is feasible. However, without a school reorganization which would permit closer student-teacher involvement and more planning time, it would not be practical to attempt developing instructional objectives on varying levels of cognition for each student.

Once the teacher knows exactly what he expects the student to exhibit at the termination of the instruction period, then he can judiciously choose the instructional methodology and hardware to be employed toward that expectation. If the basic instructional attack has not been structured, any innovations which the teacher may initiate will be only icing or stop-gap measures.

Although the supervisor's main effort will be in assisting teachers, he also has a significant responsibility to the principal because educational innovations are no longer confined to isolated departmental changes. The nature of some innovations, such as team teaching, modular scheduling and large-small group instruction, is such that they have become whole-school projects concerning most departments; therefore, the supervisor will have to advise the principal about the industrial arts' participation in his school's project.

Supervisors, as members of the central staff, have the opportunity both to promote and to consult on industrial arts programs. Whenever pilot programs prove successful, the information concerning these programs must be disseminated to principals and teachers. This dissemination, to be effective, should involve a visitation to the pilot project by the principal and his teachers.

As school administrators promote endeavors, such as demonstration schools and

educational parks, it will be up to the industrial arts supervisor to see to it that the industrial arts programs and facilities within these projects will be of a type and quality commensurate with the nature of the educational undertaking.

If the industrial arts programs are to become an integral part of innovative projects, they will have to offer avenues that complement the philosophy of the projects. Too often, school curriculum projects have passed by the industrial arts departments, thereby relegating the "shop" as some type of static appendage to an evolving curriculum.

In summary, education, and industrial arts as one of its phases, is on the threshold of an era in which the responsibility for learning is being shifted from the teacher to the learner. Under this type of program, the teacher will become a consultant/manager to the learning process. Designing learning experiences will become one of the primary tasks of the teacher; actual teaching, as currently perceived, will be limited to a few hours per week.

Instructional planning, technology and creative administrative concepts have materialized to the extent that we now have the means to effect radical changes in public education. Attempting to teach students as individuals is a challenging endeavor – industrial arts has the historical background and potential to lead the schools in educational innovation.

Mr. Freed is Industrial Arts Specialist, Curriculum Improvement Center, Shepherd College, Shepherdstown West Virginia.

Th-10.3 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO ELEMENTARY SCHOOL INDUSTRIAL ARTS

Chm., Robert Hawlk; Rec., W. A. Mayfield; Speakers, Delmar L. Larsen, John Debes, John Giavonnoni, Emil Hoch, Wayne Wonacott; Host, James J. Kirkwood.

INDUSTRIAL CONCEPTS VIA TRANSPARENCIES

Delmar L. Larsen

The Department of Industrial Education at Eastern Michigan University will implement a restructured two-semester-hour course in industrial arts for the elementary grades, during the fall semester 1968-69. The weekly schedule will consist of a one-hour lecture with a student capacity of 200. This single lecture will be correlated with eight separate two-hour laboratory sections of 25 students each which will also meet once a week. The eight laboratory sections included in this new structure are to be taught by graduate assistants.

The aforementioned large group instruction in industrial arts for elementary school teacher preparation has stimulated the preparation of selected overhead transparencies. One basic need was to develop a number of projectuals which will teach selected industrial concepts and/or introduce and promote possible laboratory activities. Projectuals were viewed as one means of communicating effectively with a large group such as that identified above.

A rationale for the use of transparencies. Projectuals should be used only when logic dictates that they are the most effective means of presenting the information to be taught. They do not constitute a panacea for solving instructional problems, but rather provide one more means of instruction with which teachers should be familiar. The only new concept in learning and instruction as applied to elementary school industrial arts, stated or implied in this paper, is the potential for using this medium of communication more effectively and on a broader scale than is presently true.

The basis upon which one decides to utilize transparencies might include such factors as:

(1) Effective and lasting learning results because the learners' visual and auditory senses are generally employed.

(2) Visuals may be utilized in a psychologically sound fashion by progression from the simple to the complex.
(3) Projectuals may provide a graphic presentation of information, thus reducing the level of abstraction.
(4) Abstract concepts may be made more concrete by utilizing a familiar context and reducing the number of symbols for the sake of simplicity.
(5) Transparencies make it possible to teach industrial concepts in a sequential or developmental pattern through a series of overlays.
(6) Transparencies may be used effectively to teach a large quantity of information in a relatively short period of time.
(7) Projectuals may employ color to add realism, point out relationships, identify significant points and/or make sequential processes easier to follow.
(8) Assembly and disassembly may be realistically shown with carefully prepared visuals.

The decision to employ transparencies in teaching leads to the need for making a umber of value judgments. What industrial concepts might be presented most effectively n this manner? What projectual design or format will best do the job? What means of resentation will promote the most efficient learning? These questions, among others, must be answered before effective communication can be established.

Classroom advantages. The use of projectuals in the teaching-learning process rovide a number of advantages. These advantages involve such factors as psychologically ound learning, teacher stimulation, ease of classroom applicability, and the wide flexibility provided. Some of the notable classroom advantages which may be identified include:
(1) The classroom may remain lighted or only partially dimmed, which makes it possible for students to take notes easily.
(2) The teacher should find it easy to maintain student eye contact in eliciting questions as part of the desirable give and take between teacher and learner.
(3) The information presented is in permanent form which permits a student to review when necessary.
(4) Large symbols and/or sizable graphic presentations make it possible to communicate effectively in large group instruction.
(5) Projectuals provide the psychological advantages of provision for a change of pace, stimulation through the use of color, allowance for student involvement, provisions for repeated exposures, and reinforcement of demonstrations as well as other means of instruction.

Preparation of projectuals. The originals should be carefully prepared after the concepts to be presented have been selected. An effective transparency must be carefully conceived and designed. Some factors to remember in preparing projectuals include, (1) the commonly accepted principles of design, (2) the need for simplicity, (3) the need for neat symbols by using those that are commercially prepared or by employing guides, (4) the use of color when it assists in the communication of the concept, (5) the application of overlays when sequential developmental stages are valid and (6) the need to view projectuals as being in a state of continual evaluation and revision.

Originals may be purchased, but must be selected with care to obtain the subject content desired. Transparencies may then be prepared by audio-visual services, if available. The process which employs heat tends to distort the plastic, making it difficult to get good focus. The ozalid or ammonia process produces a flat, higher-quality finished product.

Letters and symbols can be placed on the plastic by using pressure sensitive letraset sheets available through audio-visual suppliers. Plastic in a number of colors with varying degrees of translucency and an adhesive backing may be used for a variety of effects. This color application is especially effective in such situations as showing relationships between views in drawing or emphasizing significant points.

Depiction of industrial concepts. The intent in this section is to identify some possible applications of projectuals in teaching industrial concepts. This will take the form of identifying selected concepts which lend themselves to this means of instruction. Some topics which may be depicted through transparencies are as follows:
(1) The relationship between views in orthographic drawing
(2) The alphabet of lines
(3) Geometric construction of given shapes
(4) Sectional views
(5) A number of safety concepts, such as the dangers of spontaneous combustion,

safe handling of tools, or the freedom from unnecessary hazards in the activity area

(6) Production as well as consumption information on products from a number of raw materials
(7) Calendaring in relationship to papermaking or plastics
(8) Adhesion, cohesion and fusion as means of fastening materials
(9) Roof styles in construction
(10) Identification of key parts of hand or power tools
(11) Concepts of cutting
(12) Techniques of hand drilling
(13) Concepts of soldering

The possibilities are as varied as the teacher's imagination and inclination to develop additional ideas.

It may be that the dynamic, dedicated teacher is the key to promoting effective learning. The alert teacher, however, will use a variety of instructional means to help meet individual differences in promoting a viable classroom program. The use of projectuals should be considered as one instructional means for effectively presenting industrial concepts.

Dr. Larsen is Associate Professor of Industrial Education at Eastern Michigan University, Ypsilanti, Mich.

Th-10.4 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF METALS
Chm., E. R. Glazener; Rec., William S. Scarborough; Speakers, Robert Bachman, Allan R. Suess; Ronnald C. Lemor; Host, Theodore Wiehe.

NEW CONCEPTS IN THE TEACHING OF METALS

Alan R. Suess

Discussion of "new" techniques for doing anything is extremely hazardous. "New" can mean entirely different things to different groups, disciplines, or even to members of the same group in different regions. The first of the "new" techniques used in metalworking to be discussed has, in fact, been used with a large degree of success by both elementary school teachers and secondary school social studies teachers for more than ten years. Keep in mind that while what I am about to discuss may not be new to everyone, it is currently being used with some success among my associates at both the university and secondary school levels.

Several concurrent developments have been taking place which are probably responsible for the first approach that I would like to discuss. Critics of traditional industrial arts programs, from both within and outside the profession, have long been taking aim at the traditional project method used in so many programs. Perhaps their most important point has been that it is very difficult to show how the manipulative activities employed can possibly meet the stated objectives, such as interpreting industry or even teaching currently salable skills.

As a result of evolving educational practice and response to valid criticism of current practice, industrial arts teachers have recently begun a transition from what has been called the project approach to a more contemporary program including problem solving, research and experimentation, and related individual and group activities which may not involve the traditional take-home project. These newer and more flexible programs demand more flexible text materials. To meet this demand, several instructors have collected supplementary materials and, where necessary, have written materials to fill voids.

The result is surprisingly similar to the social science "vertical file" system of providing supplementary instructional materials for independent study and the supplemental readings used by elementary school teachers.

Development of these supplementary materials has been occurring for several years. Perhaps one of the most important factors in the development of these materials has been the research in programmed instruction. Proponents of programmed instruction praise its ability to meet the needs of a wide range of students because of the self-pacing nature of the new instructional materials. Early research indicated that the teaching machine was very important. Proponents insisted that the mechanics of the machine insured mastery frame-by-frame, and the machine was thereby the key to the initial successes reported for programmed instruction. Next, studies comparing the teaching machine with identical programs adjusted only for use with the machine brought the era of the rise of the program and the decline of the teaching machine. The next step was the comparison of programmed and conventional text materials. This research suggested that both programmed and expository materials were effective. More important, both types of materials were an effective, economically feasible and efficient method for teaching subjects in the self-pacing environment of the industrial arts laboratory.

Several such booklets have been developed by graduate students at Purdue and are now undergoing field testing. The format of these booklets is also under study. For example, one booklet uses photographs and copy typed on index stock, and bound in a loose leaf notebook. All other booklets are plastic bound but vary in terms of illustration format. Post-test data will be gathered in early May on the effectiveness of two of the booklets. The graduate instructor using these materials, however, reports that the amount of time required to teach the materials covered has been reduced to a fraction of the time formerly required, and that student reaction has been most favorable.

The goal of every teacher must be to provide his students with knowledge that can be applied to future problems which differ from the problems studied in the classroom. Typically, a teacher tests what he has taught, but seldom measures whether the students can transfer the classroom problems to everyday situations. To illustrate, ask your best students in your most advanced metals class how to square and size a ream of paper using a paper shear, or how to square a block of acrylic plastic and restore its surface finish with a minimum of dimensional distortion. My best guess is that they will not be able to answer either of these questions, even though they would be able to tell you precisely how to square a sheet of galvanized steel using the squaring shear or how to square and polish a piece of tool steel. The reason is not that the students are incapable of learning this content, but rather that industrial arts teachers have become highly skilled in teaching "how-to-do" a wide variety of specific skills. This approach limits the generalizability of operations across materials. For example, when the operations used in squaring <u>any</u> material are analyzed, it becomes apparent that work always progresses from a known to an unknown surface. The known surface is continually placed against reference planes such as machine tables, stops, etc., regardless of material. Thus squaring sheetmetal, plywood, paper, tool steel, plastic or any other material can be generalized. Of course tools and/or machines used to accomplish the task will vary with materials, but the fundamental remains constant.

The extremely large overlap of content across materials has led to the development of courses with a materials and processes orientation rather than the processing of <u>a</u> material, which has been the dominant organizational pattern in industrial arts. In an attempt to maximize the efficiency of our undergraduate teacher education program, we have established a materials and processes course as a prerequisite to all laboratory courses. Typical units include squaring, adhesives, abrasives, mensuration, coating and finishing, fasteners, etc., with instruction based on the overriding factors involved in the operation or procedure rather than the application to a specific material. Our ultimate goal is to eliminate the time-consuming overlap of instruction such as abrasives in metals, abrasives in woods, abrasives in plastics, at the expense of breadth, depth and technical skill in the specific materials in the advanced courses.

Although I have used an example of a course which is now in operation at my institution, several public schools in the area are operating similar programs and have had several years' experience with them. Quite frankly, our program is an attempt to incorporate successful aspects of secondary school materials and processes courses and avoid the pitfalls they have reported. A sure-fire formula for failure is to teach six weeks of woods, six weeks of metals, six weeks of drafting, and call it a semester of materials and processes.

Dr. Suess is Associate Professor at Purdue University, Lafayette, Indiana.

Th-10.5 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF GRAPHIC ARTS
Chm., C. E. Strandberg; Rec., Harold Balzer; Speakers, Alvin E. Rudisill, Sanford E. Rich, Clarence L
Heyel; Host, Sam C. Cobbins, Jr.

PROGRAMMED INSTRUCTION FOR TEACHING MANIPULATIVE TASKS

Clarence L. Heye

With new instructional content becoming available through technological innovations and scientific break-throughs, educators have become concerned with the problem o attempting to teach more material in the same length of time.

Some school systems have attempted to alleviate the problem through the use of programmed materials. Usually the programmed instruction has been in the cognitive areas such as mathematics, English, psychology, spelling and some areas of electronics. Research indicates that the use of programmed instruction, in general, is as effective as conventional means of classroom teaching, with the program often teaching the student in less time.

Instructional programs have the following to their advantage: (1) The degree o effectiveness remains constant because programs are not subject to the emotions of the subject teacher; (2) the material taught and presentation approach are always the same; (3) the student can proceed at his own rate; and (4) the program can be used by students who were absent from class, with assurance that the identical lesson is presented.

However, instructional programs have their disadvantages: (1) They lack the motivational qualities that a teacher adds to a lesson; (2) they are a mechanical means of teaching and repeated usage may be boring for the student; (3) if a machine is used for presenting the material, the possibility of a mechanical failure exists; (4) programs present a canned means of teaching; and (5) programs must be written, used and re-written. Some programs, however, can be commercially purchased.

There are basically two major programming techniques, one advocated by Dr. B. F Skinner, making use of the linear or single track method, and another favored by Norman Crowder, which makes use of multiple choice responses and the branching technique There are, however, several modified programming techniques that lie between the Skinner and Crowder approaches.

These are diagrammed here.

I. LINEAR OR EXTRINSIC

CHARACTERISTICS

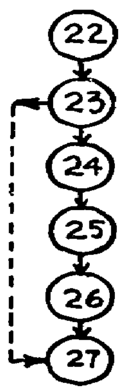
a. Ordered responses.
b. Short items.
c. Slow, steady progression of subject matter.
d. Constructed responses.
e. Small steps.
f. Minimal error rate.
g. Direction toward least able student.

II. CONVERSATIONAL CHAINING

CHARACTERISTICS

a. Strict sequence.
b. Constructed responses.
c. Response contained within context of next stimulus.
d. Responses capitalized or underlined.
e. Conversational nature.
f. Statement made prior to the program about the purpose(s) of the lesson.

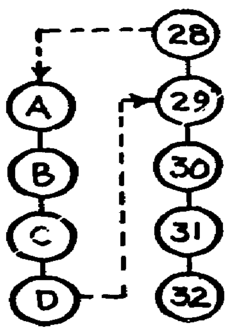
III. MODIFIED LINEAR PROGRAMS



CHARACTERISTICS

a. Faster learners may skip frames.
b. Slower students may review.
c. Program similar to straight linear approach.

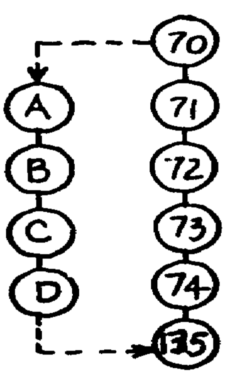
IV. LINEAR PROGRAMS WITH SUB-LINEARS



CHARACTERISTICS

a. Upper ability level student may enrich himself.
b. Students who desire this enrichment may take items a, b, c and d at left.
c. Other aspects similar to the straight linear approach.

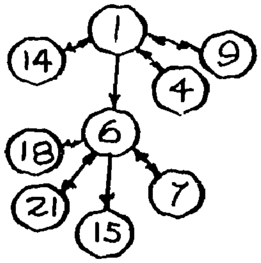
V. LINEAR PROGRAMS WITH CRITERION FRAMES



CHARACTERISTICS

a. Allows for different backgrounds.
b. Criterion or test frames are inserted at 70a, b, c and d in order to determine whether student has mastery of sequence from 70 - 135.
c. Other aspects similar to straight linear approach.

VI. BRANCHING OR INTRINSIC PROGRAMS



CHARACTERISTICS

a. Material given in small units . . . larger step size is used than in linear programming.
b. Student administered a short test of multiple-choice type.
c. Test response indicates where student is to move next.
d. Error rate not as much a matter of concern as in linear programming.
e. Programmer must be alert to possible problems encountered by student and to be able to construct analytical test items which will discriminate between full understanding, partial understanding and no knowledge at all.

Several studies have been made regarding the effectiveness of using programmed instruction in teaching industrial arts. Armand Hofer, a professor at Stout State University, accomplished a study dealing with the teaching of a manipulative skill in industrial arts in 1963. The study compared programmed methods of teaching metalworking operations with teacher demonstrations. Hofer, working with seventh graders, found that in the area of terminology programmed materials could be expected to produce slightly higher achievement than teacher demonstrations, with the achievement more pronounced at the lower ability levels.

Paul Manchak of the US Office of Education studied the effectiveness of programmed instruction as compared to the conventional instructional method of teaching a phase of electronics. The performance aspect of the study involved the use of an electronic grid-dip meter. Manchak, working with senior high school students, found the programmed method and demonstration method of teaching equally effective.

H. James Rokusek, Eastern Michigan University, completed a study in programmed instruction comparing a programmed booklet to a lecture graphic technique of teaching the history of metals to ninth grade boys. His conclusion indicates that the programmed booklet produced an initial degree of superiority over the lecture graphic method as measured by written retention tests. However, after six weeks, little difference between groups existed as far as retention was concerned.

Very little has been done in the area of programmed instruction for the teaching of graphic arts. The Eastman Kodak Corporation reported usage of programmed techniques for the teaching of elementary photography to their employees, but to my knowledge these programs were never made available for public school usage.

In late 1966 and early 1967 I conducted a research study concerned with the effectiveness of two methods of programmed instruction teaching a method of locking-up a type form for printing. Individual booklets as well as 35mm slides were produced. The booklets were used for individual instruction and the 35mm slides were used for programming an entire class. An electronic pacing device was used with the slides, so that a frame would be changed only when the last student in the class had responded. The program made use of the conversational chaining, linear approach previously presented.

Results of the study indicate that both techniques of programmed instruction were equally effective with the cognitive material for high and low ability levels. Significant differences were obtained on a test of performance, however, for the lower ability subjects in favor of the programmed booklet.

In closing, I'd like to point out that in all the studies I've read regarding programmed instruction, all have appeared to be at least as effective as the classroom teacher. Some programs used to teach manipulative skills can do so in less time than the teacher demonstration. It appears, then, that we might look toward this technique to help us in teaching more content to more students. It might also be used to teach some of the basic elements

f graphic arts, including history, measurement and printing theory, as well as some of ıe psychomotor skills connected with graphic arts education.

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paradigm based on this reference.

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'h-10.6 AIAA

ipecial Interest Session

NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF DESIGN AND DRAFTING

:hm., Ned Sutherland; Rec., J. George Williamson; Speakers, James W. Fristoe, A. Milton Garrett, John Parr; Host, Virgil L. Carter.

NEW CONCEPTS IN DESIGN AND DRAFTING

John D. Parr

We live in a rapidly changing world. This statement is trite and yet it expresses the position in which we find ourselves today. Yesterday is history, we are living today and

we must plan for tomorrow. By the time we end this day we will find that in many respect this old world will be a better place in which to live and, regretfully, in some respect it will reflect our errors and failures.

We find ourselves constantly broadening our vocabularies to include the new term being devised to describe new methods, products and processes. Think of some of th terms that we use today that were unheard of as recently as ten years ago: Cybernetics computer instruction, programmed learning, team teaching, educational television, pro fessional negotiations and many others.

The first problem in discussing "New Concepts in Learning and Instruction Applie to Design and Drafting" is to limit the topic to a couple of areas and develop these int a meaningful presentation. This I hope to do by picking two concepts, namely team teach ing and problem solving.

I have intentionally stayed away from computers and numerical control drafting. I am of the opinion that it is much too expensive for most public school systems at th present time. Last year I heard a man say that any instructor worth his salt should as for a $25,000 computer. In most school systems he would have been laughed out of th county. Many systems are in serious financial straits and about all that a teacher ca ask for is books, tools and supplies.

From my contacts with the chief engineers of several divisions of General Motor and with the teaching staff of General Motors Institute, I find that they would all be in terested in setting up a team approach to teaching design and drafting. This would be little different from the approach as we know it. They have indicated a willingness to sen a man into a secondary school to assist a teacher in presenting a particular concept to class. This industry person could give a different approach to a problem than a college trained industrial arts teacher.

Picture a situation in which a teacher might want to introduce a class to jig an fixture design. Unless he has had industrial experience in tool and die design, he migh feel quite inadequate in this area. A local industrial firm could send in a man to help in troduce simple jigs and fixtures to the class; this could be a learning experience for bot the teacher and students. Industry in turn would benefit by having future employees ex posed to an area that is not ordinarily covered in secondary school drafting.

I am very much concerned about what happens to the creative child in our schools to day. I recall Dean Kimball Wiles saying at our Tulsa Convention that "there is a vas difference between IQ of a student and his Creativity Index. Teachers generally like t have students with high IQ's but they feel very uncomfortable with youngsters with a hig creativity index." These two measures of ability are not necessarily related. Think, i you will, of the special education students who are years below the norm in academi work but are on or above grade level in art and industrial arts.

Creativity is rather hard to define. The World Book Dictionary describes it as: hav ing the power to create; inventive, productive; approaching the realm of art, imaginative Torrence, in his book <u>Rewarding Creative Behavior in School</u>, describes creative thinkin as taking place in the process of sensing difficulties, problems, gaps in information, miss ing elements, making guesses or formulating hypotheses about these deficiencies, testin hypotheses and communicating the results. Arnold Toynbee, in his paper entitled, "I America Neglecting Her Creative Minority?", states: "To give a fair chance to potentia creativity is a matter of life and death for any society. This is all-important, because out standing creative ability of a fairly small percentage of the population is mankind's ulti mate capital asset, and the only one with which only Man has been endowed."

What has this to do with the topic at hand today? It has a great deal to do with it. I our classes, we have the opportunity to help develop the creativity with which our student have been blessed in varying degrees. We must develop natural talent by encouraging ou students to be creative and to learn to handle problem-solving techniques.

All too often our courses are organized only on the basis of a textbook, and many c these are the same today as they were 30 years ago. Students are not presented open en problems. We should not sell our students short; they have the ability to handle problem solving techniques if given the chance.

To prepare this paper, I interviewed chief engineers and architects from variou industries to see what qualities they look for in prospective employees, and in ever case they wanted a young man with a good foundation in basic skills of drawing, plus th ability to think through a problem. Each industry has its own individual method of pro ducing drawings. They feel that they can instruct a new employee in their company pro cedures in a short time.

Will this technique work well at the secondary school level? I would have to give a very emphatic yes. I have seen examples of problem-solving handled very well. In Webber Junior High School in Saginaw, Michigan, the mechanical drawing teacher, John Schmude, uses a specification sheet with his students when they are on a unit in architectural drawing. This sheet gives the students all of the pertinent information about the house that should be designed. The students then design the floor plan. The results are really outstanding.

The Michigan Industrial Education Society sponsors a skills competition each year in which students are given a problem and must design an object according to the specifications. An example would be designing a cabinet to hold drills and taps; each student or contestant designs a cabinet within a time period of 90 minutes. The results again are outstanding.

One last example, at a different level, would be the General Motors Institute in Flint, Michigan. The students have to complete assigned drawings from a textbook as part of the curriculum. Each week they are assigned very challenging open end problems. An example of one of their problems was designing a fixture to hold two pipes that cross. The lines carry an inflammable fluid and a caustic solution. A sympathetic vibration is set up in the pipes that could crack or break the pipes at a bend. The problem is to design a clamp or holding device that can be assembled on the pipes with bolts or screws. The device must hold the pipes apart and damp out the vibrations. The results are very interesting. Obviously, the students can do designs of this type if they have teachers with enough vision, ambition and creativity to think up problems. This is not an easy way to teach. It requires a great deal of work on the part of the teacher, but it certainly is well worth the time invested.

We should try to develop in our students the ability to envision the solution to a problem, as did the man who took his first look at the Sahara Desert and said, "Man, what a place for a parking lot!"

These are not new concepts; they have been with us for some time. I do sincerely believe that our courses would be much more interesting, meaningful and productive if we could break the habit of being completely textbook bound. Help is available if we will look for it and ask for it. The professional engineering organizations have offered their assistance to any school that will ask for help. Avail yourselves of this help.

Another recommendation that has been made is that drafting teachers work as detailers in local industry during the summer months in order to learn the new industrial techniques.

I feel that it is vitally important to shake up our curriculum with modern, up-to-date techniques or we will be phased out of the picture. Other organizations stand ready to pick up the challenge of industrial education if we fail. We cannot afford to become complacent. We must think ahead and foresee the problems that our students will face five or ten years from now. As any good duck hunter knows, you must aim at the point where the duck will be, not where he was when you fired. Education has always been accused of driving the tack where the carpet was yesterday. Government economists tell us that by 1975, three-fourths of the workers will be dealing with products not yet invented today. They also indicate that each high school graduate will change his vocation twice in his lifetime; that 20% of the workers will be unable to work because they have been trained for obsolescence, and will be unable to be retrained. Today only 6% of the jobs are for unskilled labor. Does this have any significance for us?

In the play, "The Devil's Disciple," George Bernard Shaw says that the major crime is not rape, murder or robbery. The major crime is the indifference which enables the enemy to breach the wall and ravish the city. Are you indifferent to modern trends in our field? Are you constantly on the alert to improve as a teacher? Are you willing to innovate and, if necessary, create? If not, you are in a rut, and, as you know, the only difference between a rut and a grave is the depth.

Mr. Parr is Principal of Webber School in Saginaw, Michigan.

Th-10.7 AIAA

Special Interest Session

NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF ELECTRICITY/ELECTRONICS

Chm., Robert Spinti; Rec., John Ephraim; Speakers, Howard Gerrish, William L. Deck; Host, Edward L. Burton.

INTEGRATING INTEGRATED CIRCUITS

Howard H. Gerris

In the next few minutes I would like to address myself to the evolution of industria arts, in particular, in the area of electricity and electronics. Through the past centurie there have been men who undervalued the working man. A dichotomy has existed betwee the "blue collar" and the "white collar" members of society. By fact or fancy thes traditions have had an adverse effect upon the origination and growth of educational pro grams which draw their subject content from the world of work.

These remarks lead to a personal conclusion. How fortunate we are, as doers an innovators, to be privileged to share our knowledge and skills with the youth of America Is there another segment of our school curriculum which so aptly displays the world c work and industry, which all Americans must understand to be intelligent and participat ing citizens?

Three convenient historical divisions of the industrial arts can be dated:

Infancy. These years date back before World War II and find their origins in the Sloy systems. The use of wood as a teaching medium was not only the most convenient, bu also reflected the nature of our culture to a remarkable degree. Toward the end of thi period, the curriculum specialists became sensitive to the steel age. The automobile wa becoming a prominent influence in our daily lives. The country and the world were grow ing smaller due to the development of a mysterious box called the radio.

Adolescence. These years were punctuated by creative thinking and a more seriou definition of the purposes and activities of industrial arts. A more definitive pattern c interrelationships between technologies and industries was evidenced by revisions in in dustrial arts curriculum. Problem-solving techniques, evaluation and design, vocationa and personal guidance, laboratories of industry and other educational practices taxed th inventiveness of the teacher of industry. New products and processes appeared. Tele vision and its impact on education and communications were seriously challenging th older methods and content of our courses. Automation was being recognized by frequer educational experiences in production-line processes. Textbooks and a wealth of othe instructional material had to be added to the shop of yesterday. The industrial arts labo ratory now requires a reference library in order to deal intelligently with industrial pro duction and scientific discovery.

Age of Maturity and Compression. Gradual changes in our industrial way of life ar relatively easy to assimilate in curriculum revision. Although education has been severel indicted for its reluctance to change and its unwillingness to make radical alterations i content and method, the pressures of the mid-20th century continue to place a burden o teachers which must be met by retooling, retraining and rededication. The crafts an project-making image, perpetuated by school shop practice for many years, must suddenl be re-evaluated, and perhaps its contribution to industrial arts objectives must be ques tioned. For fifty years curriculum change in industrial arts has been an evolution. Sinc 1950 it has been a revolution. We now live in the sophisticated and exotic age of spac ships, computerized information systems, automation and an assortment of labor savin devices not even a part of the wildest dreams of the late forties.

The transistor was discovered in the Bell Laboratories in 1948. Since that time, th transistor has become the giant of the electronic age. Its small size, its ruggedness its reliability have opened a new era in miniaturization and portability of electronic equip ment. Never before has a tiny hunk of solid material had such a tremendous influence o our daily lives, our national wealth, our world security and our health and pleasures Would you believe that this amazing component is rapidly becoming displaced by integrate circuits, so small that they are visible only through a microscope?

Electronics and its ability to amplify and control has become the interwoven linkag between all trades and industries. It is involved in all the basic sciences. To interpre modern industry to our students in industrial arts becomes increasingly more difficul without a firm fundamental education in electronics. The computer alone is reshapin the whole pattern of our business, industrial and private lives. Fifteen years ago ther were fewer than 150 of these electronic marvels in existence. Today, over 40,000 elec tronic information systems are found throughout the world. It is predicted that a funda mental "hands on" knowledge of the computer will be required of all college student in the 1970's.

What can we do about it? What changes in our teaching behavior are predicted as our wareness of this dilemma becomes acute? Shall we phase industrial arts into a leisure ime preparatory crafts course? Or shall we confront the progress of industry and reorganize and revitalize and update our instruction to be truly representative of industry? hall we meet the needs of our students who must enter and live in this age?

May I suggest these implementations?

(1) Continual revision and updating of course materials and instructional aids.

(2) Closer contact with industry by means of field experiences, industrial speakers nd advisory committees.

(3) Administratively "run your shop" under standards of housekeeping, management nd organization which will reflect your judgment as to the excellence and significance f the applied science which you teach.

(4) Maintain an open mind and be constantly aware of the research and development n electronics education. Seek better methods – improve retention – find the path to chalenge the minds of your students.

(5) All teachers regardless of subject matter disciplines must unite as an educational eam. The industrial arts man with his broader knowledge and skills, and with his ractical approach and effective student rapport, can contribute substantially to the team ffort. The whole team will be greater than the sum of its parts.

(6) Remember, the most exotic space craft, the most sophisticated computer, the nost intricate and complicated automation system and the simple one-transistor radio – ll are based on fundamental concepts and understandings of basic theory of the science f electronics. Emphasize and re-emphasize the fundamentals. Do not permit your tudents to build their house of electronic knowledge on a foundation of sand.

The solutions must come from the best collective thinking of our profession. I am onfident we will meet this challenge and fulfill our obligation to American education.

Mr. Gerrish is Professor of Industrial Studies at San Jose State College, California.

NEW CONCEPTS IN ELECTRICITY/ ELECTRONICS

William L. Deck

To speak of the title "New Concepts in Learning and Instruction in Electricity/ Electronics", we must use some time to analyze it. What is involved?

New has many meanings, for example, lately made, produced or brought into being. This does not suit our purpose. Another meaning – lately come to knowledge, not being known – provides a better meaning for educational purposes.

What did the program planners have in mind when the word "concepts" was selected? What is its meaning? A concept is an idea which has been formed by thinking and which is permanently embodied in language by a word or other definite symbolic expression. It is n intellectual activity. It is a universal mode of thinking.

Concepts are composed of perception. We perceive through our senses concrete objects. For example, we perceive through our senses a particular object – a television set. To form a concept of the television set is to think in general terms of the relation of the mechanism of the parts to the purpose of the whole.

In the study of electricity and electronics we find many ideas which have been formed by thinking and experimentation, and which have become permanently embodied in our language by words or terms and symbolic expression as schematic symbols and formulas. Many of these have lately come to the electricity and electronic educational knowledge.

Here are some of these ideas and terms in electricity and electronics:

Zener Diode - These are essentially variable forward impedance rectifiers used in voltage regulator circuits.

Tunnel Diodes - P N junction rectifiers possessing a negative resistance when correctly forward-biased.

Bias - usually thought of as a negative voltage on control grid. Since the development of the transistor, the terms forward-bias and reverse-bias are developed by the technique of connecting batteries.

Hybrid Components - are components serving some function other than purely elec-

tronic. Other functions may be mechanical, optical, chemical or magnetic, for example electromagnetic actuated switches such as relays, vibrators, and choppers; meters and servomechanism components; audio devices such as loudspeakers, microphones and headphones.

Field effect - This is so recent that we do not know its real meaning. It is used in test instruments and combines the principles of VOM and VTOM in the same instrument. Voltage cells are employed instead of line cord.

Electro-Acoustic transducers - There are many forms of this concept, and a few examples as phonograph pick-ups, microphones, loudspeakers, headphones, are illustrations.

Thermister - is a resistor and provides a controlled amount of resistance change according to the amount of current flowing in the resistor. It usually has a negative temperature coefficient; cold resistance is more than hot resistance.

Magnetostriction - is the act of forcing the magnetic domains to become aligned in a ferromagnetic material and causing a slight change in physical dimension. For example nickel can be reduced in length about 20 parts in a million by a very strong magnetizing force of 6,000 ampere-turns per inch.

Covalent bonding - is the sharing of electrons by atoms. The shared electrons bind atoms to form molecules. A water molecule is composed of two hydrogen atoms and one atom of oxygen. The electrons in the outer shell of oxygen are the valence electrons, and the single electron of the hydrogen is the valence electron. The single electrons of the hydrogen atoms are shared with the six valence electrons of the oxygen forming a shell with eight electrons and a stable molecule of water, and if it is pure, it is a good resistor.

Ionic or Electrocovalent bonding is accomplished by an atom gaining and an atom losing electrons. For example: in the compound table salt, NaCl, or sodium chloride, one atom gives up an electron thus becoming a positive ion, and the other gains one electron to become a negative ion. The two ions are bound together by electronic attraction. The molecule has eight valence electrons and is stable.

Metallic bonding is the bond with which we are concerned in basic electricity. For example, copper has one valence electron. In a copper wire the atoms are close together and the outer shells overlap. The free or valence electron in the wire changes shells or orbit in a random manner. Therefore, all atoms share their outer or valence electrons and become bonded together. Valence electrons are very important in creating transistors, diodes or semiconductors.

Semiconductors. Conductors have their valence shell less than half full. Insulators have their valence shell more than half filled. Thus, substances that have atoms with 4 valence electrons are called semiconductors. These conduct better than insulators but poorer than conductors. Some semiconductor examples are germanium, silicon and selenium.

Hole flow or hole current is accomplished when valence electrons are forced to leave their valence shell. This creates a free electron. Therefore, in such an atom in a semiconductor there is a space that should have an electron. This space is called a hole.

Holes occur in the valence bond or shell with valence electrons. Hole flow or current is the apparent movement of holes due to valence electron current.

In the schematic symbol of a PNP transistor, the emitter is indicated by an arrow that points in the direction of the hole flow. The emitter is said to inject majority carriers into the base; therefore, the p-type emitter is shown with arrow pointing to the base. The n-type emitter has the arrow pointing away from the base to show that electrons are being injected.

Polymers that conduct electricity have been developed by research laboratories. This product has great possibilities in the design and manufacture of both industrial and consumer products. This new material can be applied like paint, and it may find applications in printed circuits. Laboratory tests indicate that it will conduct electricity indefinitely without undergoing change.

Semiconductor Laser is a new type of laser developed by General Electric Laboratory. Coherent light is generated by passing an electric current through a semiconductor crystal.

Lasers are a family of electronic devices that generate highly directed light beams of a single frequency. The waves are produced "in step", and are called coherent. Lasers are believed to have potential importance in the field of communication, because coherent light waves can be looked upon as radio waves of extra high frequency with a carrying capacity thousands of times greater than radio waves. It has been suggested that lasers will have possible application in computers, data processing systems and eye surgery.

Miniature metal-ceramic tubes. This electron tube is so small that several hundred an be held in the palm of the hand. Its performance is equal to or better than tubes in adio and television sets. One reason for high performance is the close relationship of nterelectrodes in the tube; this causes interelectrode capacity to be low.

The metals used in the tube must not evolve gases that can be harmful to cathode mission. One of the newer metals, titanium, is excellent in this respect. Once it is egassed it evolves essentially no other gases, even when heated to temperatures high nough to process the tube. In addition to this feature, it has a "bonus value". At high emperatures it will retain many of the gases that come into contact with it. For example, t can dissolve up to 30% of its own weight of oxygen. This type of metal is called a 'getter".

Many more technical terms and ideas could be presented such as: fuel cells, dilectric eating, microwave cooking, ultrasonic generators, events per unit time counters, and netallic-vapor lamp.

Industrial arts teachers have used bell circuits, motor winding, buzzer circuits, light ircuits, magnetism, old radios and kits of various kinds in teaching electricity and elecronics. In many cases it was a manipulation of parts, with very little success in undertanding electricity or electronic concepts. This type of learning and teaching is dominated y sensory perception that did not develop concepts, because thinking was difficult without content.

Today, content is available and test equipment is plentiful. Industrial arts teachers nust learn the content, do experiments and create experiments to test the content. They leed to do some real thinking about electricity and electronic content which will develop better understanding of old concepts and create some new ones. The industrial arts teacher should be able to visualize the schematic of the electrical device he is teaching and lemonstrating. He should think of the relationship of the mechanism of parts to the purpose of the whole.

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Th-10.8 AIAA

Special Interest Session

NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF POWER AND MECHANICS

Chm., Robert A. Renner; Rec., John E. Streif; Speakers, James Grossnicklaus, Karl J. Windberg, Martin Shrader; Host, Bruce W. Johnston.

POWER MECHANICS AND SCHOOL DROP-OUTS

James L. Grossnicklaus

Power mechanics is a subject that is causing much controversy in schools. There are several definitions of power mechanics. Originally it meant the study of all forms of power, but now it includes everything from natural power to nuclear power, and each school places a different emphasis on some phase.

Some schools teach a 9- or 18-week session, planning the course around small gasoline engines. Other schools include the automobile and its components. Still others try to

cover all forms of power, with little emphasis on internal combustion engines and concentrated emphasis on steam, electric, nuclear power, etc.

Schools have excellent equipment and facilities for ood, metal and electricity-electronics to challenge students to go as far as they are capable. However, people tenc to be afraid of power mechanics. It is not an expensive course compared to other industrial arts courses. The school and the instructor should set policies concerning the course without these it can run into trouble, if it becomes a place for students to tinker rather than to learn.

Power is being used in many forms, shapes and sizes. This convention would not be possible if it weren't for modern-day aviation and fast jets. Millions of engines are used to power lawn mowers, outboards and power saws, and nine million new automobiles are anticipated this year. Many boys are interested in power mechanics, and if schools would offer this course, they could help keep potential drop-outs in school.

Drop-outs are not necessarily all below-average students. Home environment, inability to read, lack of motivation or finances are also contributing factors. To a student who can't read, sitting in a classroom for five or six hours a day struggling through English, math and science is a waste of time. His thoughts are on getting a job and a car. Gradually he loses interest and quits.

Power mechanics can be used as a motivating force to keep students in school. English, math and science can be integrated into the course, because students soon discover that academic knowledge is needed to work on cars, outboards, motorbikes, etc. Students need math: to figure cost of repairs, to read micrometers, to measure bores, etc. Bring math in when the student discovers he can't figure specifications, and bring reading in when the student can't read directions. Using books on power will motivate him to want to read. I am not against academic courses, but schools often fail to show relationships among subjects. Schools with well-rounded and well-planned curricula can help students, rather than hinder them.

Mention engines and many people think "hot-rod" – souped-up cars and racing. Some people comment "we don't want cars, outboards, lawn mowers around a school." If actual components are not used, boys tend to lose interest regardless of grade level. Small engines can be stored easily and require a minimum of space to disassemble and assemble. However, models and cutaways can be used effectively when combined with real components. Boys don't learn to pass a football by looking at pictures and never feeling or throwing the ball. The same is true for power mechanics.

Having nothing but theory in power mechanics classes is a fast way to cause students to lose interest. Theory and lab work go hand in hand. To a student, the lesson is far more effective if he discovers the need to understand, and how something works. This is where theory and lab can be tied together. If a small power source or an automobile is brought to class, a student, not doing well in his academic subjects, will suddenly become an above average student in power mechanics. This is where his interest lies. By permitting him to bring in his power source, school takes on a new meaning. In some cases he may be given an opportunity to demonstrate or even help some other students. He will gradually develop self confidence. It may be the first time anyone has shown an interest in him or in what he is doing. While this may be an exceptional case, it is used as an example of why we need a wider choice of courses in industrial arts.

I sincerely believe power mechanics has much to offer, and schools are doing their students an injustice if they have only a few weeks of theory or no class at all. There are, however, some fine power mechanics programs in operation in the US today.

A student disinterested in school may find new interests when given the chance to work on a familiar object. If parents don't encourage him, if schools don't offer courses to interest him, where will he learn? Schools should provide the student with a chance to prove himself. This is done in academic subjects but until it applies to something he knows, he feels it is useless to attend school.

Power mechanics has a multitude of experiences to offer. It is a dynamic process which takes advantage of the new technology that industry has to offer, such as up-to-date test equipment, new designs and a variety of applications current with our youth today. All of us are aware of the vast amount of money that industry spends for advertising directed toward youth. Why not spend time and money to better prepare our youth for a mobile society? It is our duty to prepare our young people for the future, and we can only do this by providing a variety of experiences that are in keeping with our times.

Mr. Grossnicklaus is Vocational Director at Philomath High School, Philomath, Oregon.

CONTRACTS IN POWER MECHANICS

Martin Shrader

Many schools are turning toward modular or flexible scheduling as a means of using time more effectively, and to allow for more individualized work for students. The traditional approach to teaching must be modified and reorganized to take full advantage of the new schedule.

Modular scheduling is based on the premise that all subject classes do not necessarily require the same amount of time; for example, a language laboratory may be more effective when held to 20 or 40 minutes intead of the traditional 60 minutes. An industrial arts or science laboratory may make more efficient use of time if the period were extended to 80 or 100 minutes.

The day at Clayton under modular scheduling is divided into 20 blocks, each 20 minutes long. These 20-minute blocks of time are called modules or mods. To illustrate how a program may look on modular, all freshman English classes meet in a large group in the auditorium for a 2-mod or 40-minute lecture period. One teacher is responsible for preparing and presenting that lesson. The other teachers are released at that time to do preparation or help the lecturing teacher. This large group is then subdivided into medium-sized groups of about 20 students per teacher for 3 mods or 60 minutes. The medium groups are then broken down into individual 1 on 1, one teacher to one student; for writing and composition conferences, a student would have a one-mod session every ten days.

Most industrial arts schedules are arranged into two levels. Level one is a lecture period that meets once a week for 2 mods or 40 minutes. Level two is laboratory and/or lecture period that meets twice a week for 4 mods or 80 minutes.

A student's schedule will have blocks or mods of time that are unscheduled. Most freshmen will have approximately 25% of their time unscheduled and seniors may have as much as 50% unscheduled time. The industrial arts shops are "open labs" where a student may come in and work at any time. Tests, films and programmed material are all placed in a resource center or library. Students use these materials during their unscheduled or free time. The resource center is run by para-professionals.

Contracts are agreements between the student and the teacher to complete an instructional unit, manipulative and/or informational units. A contract may be written for the highly motivated student to go beyond the regular class program. This student may study in depth a particular phase of an industrial arts area. This type of contract is not unlike the third level of the proposed American Industries Program from Stout State University. A contract may also be written or designed for a student who had a full or conflicting schedule and a very limited amount of unscheduled time. For example our beginning drafting course is written in contract form. A student may contract a single unit such as pictorial drawings, geometric solutions or lettering. These need not be taken in a specific order; the student may select the unit he wishes to do. Some units, however, must be taken in a definite order, such as orthographic projection to auxiliary views to section views. Thus a student might take two or three years to complete the total number of instructional contracts that make up the drafting course. He is not scheduling time, but is contracting a unit of work that is completed at his own rate of speed.

Contracts may be written for different units of credit. We have several contracts for 1/8 unit credit corresponding to about six weeks' work in a regular course. Contracts may be written in a unit area or a continuation of areas, for example power mechanics and metals. In power mechanics, the contract might be to study refrigeration and design a deep freeze, in metals it could be the actual construction of the unit.

A third type of contract could be written for a person who has a great deal of unscheduled time and would just like to work in the shop. For example, boys or girls may work out units in wood laminating, finishing and upholstering, home mechanics or lapidary. These students are primarily interested in developing an avocation.

The most difficult part of writing a contract is the planning. The responsibility of learning the information is primarily the student's. The teacher does not "spoon feed" the student. The teacher's role is that of a resource person. Therefore, care must be taken to outline the requirements of the contract, where references are to be found, include test of workmanship and approximate time required to complete the contract.

Our contract on oxyacetylene welding illustrates the basic format that we are using

for our short term contracts. Students taking this contract first receive their related information and safety rules by completing a programmed instruction from Dupont, which is of the lineal type. A student answers a question and pulls a cover down, which gives him the answer to the previous question and a new question. He then views our slide-tape sequence which takes him step by step through the set-up and operation of our welding equipment. Then he must take a written test to determine whether he can continue to the next stage or if he must go back to restudy the previous material. Next he must observe a student in the welding process. Then he is checked out on the equipment by the instructor and is started on a series of prescribed exercises. Lastly, the student produces a project from a limited selection, or of his own choice with the instructor's approval.

This short term contract of 1/8 unit credit is equivalent to a 5-day-a-week, 6-week traditional program. These short term contracts relate well to other subjects, such as welding in art sculpture, and power mechanics to physics in fluids, mechanical and electrical devices that show the practical application of physical principles.

At present, Clayton offers only a basic course in power mechanics. All advanced work in this area will be by contract. The traditional course covers the basic principles of the following areas: power transmission, fuels and lubricants, internal combustion engines, steam, atomic and solar energy and experimental power source. A student who is highly interested in one of these specific areas could take a contract for in-depth study in that area. As an example, a student may be interested in further study in the area of internal combustion engines. He may choose contracts in one of the phases of this area or a combination of phases. This area may contain contracts in the following units: small gasoline engines; automotive engines systems; reaction; rocketry; gas turbine. Another example of this area unit's contract may be titled as follows: power transmission – hydraulic; pneumatic; refrigeration; solar energy; experimental power sources.

Because of the many activities going on in the shop at one time, tools and materials must be readily available at all times.

The contract concept can also fit the traditional schedule by releasing students from study hall and allowing them to schedule during another industrial arts class. The contract provides opportunities for the academic or bright student to schedule industrial arts activities during his high school years that he would otherwise not have the opportunity to take. It promotes cooperation and team teaching with other school subjects, which saves time by eliminating duplication of the same materials.

Mr. Shrader is Industrial Arts Instructor at Clayton High School, Clayton, Missouri.

Th-10.9 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF WOODWORKING

Chm., Herbert Y. Bell; Rec., John R. Calder; Speakers; Ward S. Winfield, Alva Jared, Lester Riggle; Host Paul E. Hokuf.

WOOD INSTRUCTION FOR TODAY

Alva H. Jared

In recent years, leaders in the field of industrial arts have been advocating the de-emphasis or even the elimination of woodworking instruction from all industrial arts programs. With this criticism, the teacher in this area should seriously and earnestly take a long, hard look at his areas of instruction. For without an evaluation, restructuring and up-dating, this most important area of industrial arts instruction might well be eliminated from the school program.

Science and technology have had a great impact upon the industrial society. It has provided a higher standard of living, more and better materials and products, as well as improved methods of performing laborious tasks.

If the previous statement is true, how has the industrial arts educator incorporated these innovations into the industrial arts program, and more specifically, into the woodworking program? The current practices in woodworking instruction were revealed in the recent US Office of Education study(1) conducted by Schmitt and Pelley. They revealed that current woodworking instruction was concerned with finishing, furniture making, cabinet making and woodturning. Thus it seems evident that woodworking instruction has not changed very much over the past few years to keep abreast of the technological changes within the industry.

In order for this program to be current and in line with our modern industrial world, changes are needed both in curriculum content and instructional methodology. Personally, I believe that the program needs to be broadened to include the major areas of the industry, as well as the related facets of these areas. For example, it should include the area of construction, with the students discussing and studying such topics as materials handling, employee relations, production planning, building economics, materials of construction and assembly procedures.

Changes are also needed in the instructional methodology. In many schools, the project has been the woodworking program. In many, not in all cases, it has been the means of instruction as well as the goal of the program. It seems that the project should be de-emphasized in value and used only when it is the best vehicle to learning. With new educational media and the abundance of conventional education materials, the instructor should be better able to present to the students the woodworking industry in its true perspective. The tools and processes which are used to teach the students should be as current and as representative of the industry as possible. It should include the use of pneumatic equipment as well as portable power tools which are used extensively by the industry.

In view of the recent technological changes, what should be the instructional units in today's woodworking program? First and foremost, we should place more emphasis on the woodworking industry as a whole and not upon the laborious operations connected with fabricating and finishing projects. An understanding of the industry should be the goal of the program and should include such units as the industry's impact upon the economy, occupational outlook information, production techniques, production planning, finance, scientific aspects of wood and woodworking, future lumber supply and others. Furthermore, it is the opinion of the writer that today's woodworking should include five major phases of instruction. These phases are as follows:

Wood Science: A student should be as familiar with the science of wood as with the structure of the atom or Ohm's Law. This area should include microscopic analysis of the various wood cells, the understanding of moisture content, shrinkage and drying distortion. In addition to these, the student should be aware of stress and strains within tree growth, lumber defects, surface characteristics and identification of wood species.

Construction: The light building area should be included in all woodworking programs. More specifically, the students in this area should become familiar with the economics, the labor relations, financing and marketing aspects of the industry while studying the specifics of construction. The specifics should include such topics as the materials of construction, the assembly of building components, preservatives and treatments used in construction, as well as on-site and off-site fabrication and erection techniques.

Experimental Analysis: Testing an experimentation should be included in the wood program as either a separate unit or as part of other units. Students should be aware of the physical and structural characteristics of wood and wood products as much as they are aware of melting points of metals or that sodium hydroxide combined with hydrochloric acid forms salt and water. This phase of wood instruction should include physical testing of wood, plywood and particle boards, fire testing, environmental testing, chemical and paint treatment testing, and gluing and fabrication testing.

Residual and By-Products: One of the most rapidly changing areas in the woodworking field is related to wood by-products and wood residual use. The more extensive uses of plywood, veneers, laminates, particle boards and hardboards by the woodworking industry should direct industrial arts woodworking teachers away from the extensive use of solid lumber in the instructional activity. Nova-wood, superwood, plastic laminates, wood distillate by-products and pulpwood are all examples of the variety of uses which are made of wood in various forms.

Aesthetics: Students need to be taught to appreciate the beauty, texture, grain structure and the color of the various woods, both in the form of solid lumber and veneers. The intrinsic beauty of wood surrounds people every minute of their lives. Today, more

than ever before, wood paneling, wood sculpturing and decorative applications of wood are being used to enhance the beauty and aesthetic appeal of buildings and other consumer products.

Many changes are taking place in the field of education, and many more are taking place in the fields of science and technology. Likewise, changes can and must be made in the industrial arts programs and the instructional methodology to keep abreast of these changes. Our programs and, more specifically, the woodworking programs, must be changed to provide the student with an insight and understanding of this industry and its place in American society. As members of the industrial arts teaching profession, we must accept the responsibility of educating today's youth by emphasizing and teaching the new techniques, new processes and necessary skills as a means of developing this potential for tomorrow.

Let's accept this challenge.

FOOTNOTE

1. Schmitt, Marshall and Albert Pelley. Industrial Arts Education (Washington: US Government Printing Office, 1966), p. 26.

Dr. Jared is Head of the Technics Department, Wisconsin State University, Platteville.

Th-10.10 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF PLASTICS
Chm., Frank Pershern; Rec., Robert Bates; Speakers, Arlo Felix, Leonard Huffman; Host, Walter J. Hall.

TEACHING INJECTION MOLDING

Leonard B. Huffman

This convention has been dealing with new concepts that concern many areas of endeavor. The forcing of a heated, semi-fluid material into a cavity and permitting it to solidify by cooling is certainly not a new concept, nor is it difficult to understand. A teacher friend recently remarked that he couldn't justify the expenditure of a thousand dollars for a machine which makes a golf tee. It might be concluded from these two statements that the process of injection molding is simple, the equipment expensive, and the tangible product negligible.

Such a conclusion would render efforts to teach injection molding rather worthless, if learning is so limited. May I suggest a broader view and attempt to identify several concepts or relationships that might be observed or learned in the molding process? They divide very nicely into three categories. Within them, related learning is nearly limitless and such related concepts will appear in question form.

Operational Concepts. These deal with aspects of the molding cycle. What is the relationship between mold temperature and part finish? How might the length of the dwell period affect shrinkage or how is stock temperature related to sink marks?

Material Concepts. Here learning is about the resins used in molding. How do viscous materials flow and how can welds and flow lines be minimized? How can jetting be corrected? How do resins differ in their ease of molding, cost and material properties?

Tooling Concepts. Concerning the mold, what are the effects of gate placement on fill time and weld lines? How is draft angle related to ejection? Do thick and thin areas contribute to warpage? Is gate land area related to streaking?

All of these concepts are necessarily related. Each is significant in interpreting the other two. It would seem that these concepts are best learned through firsthand experimentation. In the operational category, "hands-on" operation of machines with various molds would be in order. To learn material concepts, utilization of different resins and

mold types would provide such opportunity. In the tooling category, development of a working mold would be most appropriate and, unfortunately, it is here that opportunity seems to grind to a halt. A visit to even a small tool and die shop will immediately convince the inquirer that moldmaking is an art requiring skill that has been learned over many years. He would see that precision machinery is essential and that good mold design is the product of much experience. Do these factors make a mockery of our attempts to teach injection molding and again render our efforts rather worthless? The remainder of this presentation will deal with techniques of building molds at various levels of difficulty. These levels have been determined by both experience and projection and the slides you will see may aid our illustration. The important thing to remember is to begin with simple and uncomplicated designs. Learning can be surprisingly significant on some small projects.

Level I. Simple, two-piece, single cavity, non-mounted molds made from castable epoxy-aluminum are desirable. Turned cavities from mild steel or aluminum are also of comparable difficulty.

Level II. Modifications such as molded threads, projections, inserts, multiple cavities and simple ejectors can increase the difficulty and add interest.

Level III. This level provides the greatest opportunity for experimentation and learning and is as advanced as would be practical for students without highly specialized skills and experience. At this level irregular shapes, undercuts, special finishes and closer tolerances are introduced. Applications for special equipment such as NC and EDM might abound at this level.

Level IV. Designs of a commercial nature that are mounted and eject automatically by means of stripper plates or ejector pins comprise this level. Such molds demand considerable experience.

All of the epoxy-aluminum molds shown in this slide presentation were made in a typical woodworking shop. A disk sander served as a mill and surface grinder. Accuracy is at times hard to believe. We refer to these as Level I and II type molds. Presently several more advanced types are being constructed in conjunction with advanced metalworking courses in the department.

Plastics is a teaching area with unlimited opportunity for making applications from other traditional areas. It is unique in its newness and adaptability. Its worth may well be dependent upon our understanding and implementation of related concepts.

Mr. Huffman is Industrial Technology Instructor at the Ohio University, Athens.

Th-10.11
Special Interest Session
NEW CONCEPTS IN AEROSPACE EDUCATION
Chm., Jack Lain; Rec., William Hunt; Speakers, Carl Guell, James Ray; Host, Raymond D. Johnson.

NEW CONCEPTS IN AEROSPACE EDUCATION

Carl E. Guell

The use of the air as a mode of transportation has exerted a terrific impact upon the world and has established new requirements for the schools of our nation.

Educational leaders and teachers are concurrently being confronted with the greatest challenge, the widest opportunity and the heaviest responsibility ever encountered by any group of people.

The generation which they teach stands face to face with a great and new frontier which has been opened by the air age, a frontier filled with adventure, danger and opportunity.

To help Wisconsin educators meet the challenge which the air age holds, the Wisconsin Division of Aeronautics has been cooperating with all of the various state educational departments and educational institutions in accordance with the Division's responsibility as set forth in the statutes.

For nearly 22 years the educational section of the Division has supervised and directed the Division's approach to the subject of aviation, education and training, which has resulted in the implementation of many aviation education programs.

In the universities of Wisconsin, the Division's efforts have resulted in the establishment of a number of summer session aerospace education workshops designed to prepare teachers better for incorporating aerospace materials into the existing programs. Most prominent among these programs have been those conducted at Stevens Point and Platteville State Universities.

At present we are encouraging several of the State universities to initiate a credit course which would prepare teachers to teach high school aeronautics courses, ground school courses for pilots in the vocational and technical schools, and to teach the ground school material at the local airports.

Over the past seven years, more than 30 local schools of vocational adult and technical education have conducted ground school courses for pilots in their evening school programs. This past year 24 schools conducted such courses with 1,081 students enrolled.

There are now two Wisconsin schools of vocational adult and technical education conducting air frame and power plant mechanics courses at Janesville and Milwaukee. In addition, an ad hoc advisory committee has recently recommended to the State Vocational Board that these programs be expanded and that an additional program be added at Kenosha. Kenosha has already been approved to conduct a career pilot training course and an aviation mid-management course.

Perhaps the greatest upsurge in aerospace interest has occurred in the high schools of the state, where there are now seven high schools conducting full-time aeronautics courses, for which one-half science credit is given.

Perhaps the best known of these programs is that being conducted at Onalaska High School under a Title III ESEA grant from the federal government. Since you have heard a great deal about this program, I shall attempt to cover it in some detail.

An experimental aviation course, the only one of its kind in the United States, is being taught at Onalaska High School. This innovative pilot project is made possible in part by virtue of a Title III grant from the federal government, which encourages usage of new ideas in education. Onalaska school authorities believe that instruction in aeronautics was long overdue in the curriculum of the nation's schools, and they are delighted that Onalaska has the honor of being the first to initiate the pilot project.

The Idea for the Course

Although the actual course offering in aviation at Onalaska High School was new, the idea for its inception was not. The superintendent long harbored the belief that today's curriculum should embody aerospace concepts. Considerable time and effort were expended by Onalaska school authorities researching the idea and determining its feasibility. Development of course of study, financing and overcoming tradition were deemed to be the most formidable obstacles.

Researching the Program

Even though the aerospace industry is the largest employer of persons in the United States today, the industry has a higher salary scale than most, and our airlines are becoming increasingly more concerned over the impending shortage of pilots and mechanics, very little is being done by the schools of the country to initiate aeronautics courses in the high school curriculum. It is quite apparent that the critical lack of information as to how to establish and conduct such a course has been the major deterrent in their establishment.

Federal Aid

When federal aid to schools was enacted, the superintendent suggested pursuing this idea for a project under Title III of the Elementary-Secondary Education Act, and another year of research was conducted.

Under the Title III guidelines, projects must be innovative and exemplary. This program is innovative in that students receive flight training as well as classroom instruction, and community resources are utilized as a laboratory situation. The experimental project is exemplary because several objectives of the program are to determine just what is needed and necessary to conduct such a course; therefore it is serving as a national pilot program.

The Proposal

The proposal was submitted to the United States Office of Health, Education and Welfare, as a three-year pilot study. The objectives of the project are as follows:

(1) To demonstrate effectively how to conduct such a course.
(2) To develop a course outline which might be used by other schools.
(3) To give students a background of aeronautics which might better assist them in determining whether they should seek additional training in aeronautics.
(4) To let students learn what job opportunities are available in the field.
(5) To provide them with sufficient flight experience which will enable them to determine whether they will make safe pilots, and thus add another valuable asset in seeking employment.
(6) To disseminate the conclusions gathered in evolution and completion of this pilot study program.

First-Year Grant and Program

A budget of $16,700 was granted to conduct the first year of the program. In this period, 20 students were enrolled each semester. Of these 40 students for the year, 19 were girls. Two parochial schools were involved, La Crosse Aquinas sending five students the first semester, and Onalaska Lutheran, five the second semester. Ninety classroom hours of instruction were given each semester. In the ninety hours, students were provided with the basic information needed to fly an airplane, as well as with an exposure to careers in the field of aeronautics.

To supplement the class instruction, several field trips were taken to the municipal airport. The various trips taken were: (1) To the cooperating fixed base operator's flight line; (2) To the Flight Service Station; (3) To cooperating fixed base operator's mechanic shop; (4) To the weather bureau; and (5) To Minneapolis International Airport. The students saw various phases of aviation and many career possibilities, on this final trip of the semester.

It has become evident that these field trips have added immensely to this career-oriented program. Not only do they provide more information relating to subjects being studied, but also they afford the student opportunities to meet and talk with the person on the job, as well as to observe the working conditions.

Utilizing Community Resources

The various personnel connected with these community resources have been most cooperative in providing excellent learning situations throughout the program. Several resource persons in the area have volunteered their services to supplement the learning process throughout the year.

Selecting the Students

Selection of students for the program was carried out by guidance personnel. It was felt originally that the major criterion in selecting participants should be past academic performance in school, and that the achievement should be above average. After the first semester, it was felt that more emphasis should be placed on the interest of the student, who must have average or above average grades. One of the main reasons for changing the priority in these selection criteria, is that the underachievers began to excel in the aviation class, and this carried over into other subjects. There has been a remarkable change in attitude by the students of Onalaska, Lutheran, and La Crosse Aquinas High Schools.

The Change in Attitudes

When final approval was received, screening of students for enrollment in the class began. It was found that the students were somewhat reluctant to ask for admission, possibly due to parental attitudes toward flying and aviation in general. People in the area were cautious and suspicious - not showing a great deal of enthusiasm early in the project. It became readily apparent that this was one of the first obstacles that had to be overcome. As the project progressed farther along into the semester it became increasingly evident that more interest was being generated in students and faculty alike. Two faculty members began flying lessons, and this is probably due to exposure to the aviation program.

There was reluctance on the part of some teachers and parents, when the program was first initiated, to accept it. This was mainly due to a misunderstanding of the major objective. Many felt the program was designed to make pilots of all participants, which was definitely erroneous.

Second Year Grant and Program

A $40,200 budget for the second year of the program was granted. This increase in budget was due to an expansion in the number of students enrolled, the need for a full-time project director, classroom instructor and additional help to handle the correspondence due to the tremendous inquiry.

The number of students was increased from 20 each semester to 60 each semester. This enrollment was drawn from a total of nine area schools: from La Crosse, Central, Logan and Aquinas, and from the area Trempealeau, Holmen and Bangor, West Salem, Onalaska Lutheran, and Onalaska Public.

Three classes were scheduled each semester to accommodate the 60 students. To prevent scheduling difficulties with these schools, a class was scheduled at 7:45 a.m., another later in the morning, and the last during the last class period in the afternoon, all at Onalaska High School. Area schools tried to arrange schedules so that the student could either travel to Onalaska High School or back to his appropriate school during a regularly scheduled study period. In this way he would miss a minimum of valuable class time.

Some students commuting from two of these schools traveled 40 miles each day to attend the class. It was also necessary for them to drive back at least once every ten days or two weeks for flight instruction.

In the second year, there were 19 girls out of 60 both the first and second semesters. Girls are extremely interested in learning more about the various career possibilities, especially in becoming stewardesses. Another possibility was brought to the attention of the classes by one of the consultants serving on the project. He related that there is a dire need for qualified secretaries at the federal level. The girls with secretarial training who participated in this program should have desirable qualifications for prospective employers in aviation. Not only have they become familiar with the terminology, but have also piloted an airplane.

Project Carryover

Several boys and girls have indicated they will continue their flight instruction toward a pilot's license. All this interest and desire for further training in the various areas of aviation indicate that the major objective of the program, to present the career opportunities in aviation, is being met.

Course Outline

A great amount of emphasis has been placed on the development of a course of study in this pilot program. The original course outline submitted with the project proposal was followed during the first semester, but it was soon evident that some revisions would have to be made.

All four program consultants agreed that by using the revised outline in the second year of the program, the learning situation was much improved due to greater coordination between flight and ground instruction. Further refinements came about as the program progressed.

A triangular cross-country flight was scheduled the first semester of the second year. Three students were scheduled per plane, and it was the individual responsibility of each one to plan the trip. After each one had completed his plans, straws were drawn to see which leg they were to fly.

Students surveyed after completion of the trip felt this was a tremendous experience in that they not only used many of the principles of flying covered in class, but were better able to evaluate their appreciation of flying from one point to another. All were unanimously in favor of including this as part of the semester's flight instruction.

A parent orientation meeting was scheduled in the second week of each semester to inform parents better of the project objectives, various activities and events, and what is expected of the student.

Another activity added to the semester's work is a parent flight, in which parents are scheduled to fly with their child. This is another phase in which the results far exceeded what was initially expected. Originally this event was arranged so parents could observe firsthand the progress made by the participants in the program. Many of the parents had not flown previously, and a very small percentage refused to participate. Many indicated they were very impressed with their child's progress, and a few have begun flight instruction themselves.

The Federal Aviation Administration Private Pilot Examination was administered to

the second semester's class (1966-67) near the conclusion of the semester. Out of the twenty students taking the exam, only one received a passing grade (70% or above). At the conclusion of the first semester (1967-68), this exam was given to this group. Out of sixty students taking the exam, four students received a passing grade.

The percentage of students passing this examination is not high. However, it is not the intended purpose of this experimental program to make qualified pilots of students enrolled. We have now learned that to do so would require much more classroom time devoted to teaching for the exam, possibly another semester. Career sessions and field trips are primary objectives of the program, although there is merit in giving students this exam experience also.

Special recognition had been given to the students in the program from the first semester on. At the end of the first semester (first year) the cooperating fixed base operator presented each student with an engraved walnut plaque. The La Crosse Flyers' Association, a group of local flyers interested in aviation education, unanimously consented to present a trophy to the student with the highest achievement in classroom work and flying proficiency each semester, and also a plaque for the runner-up. This fine gesture has given added incentive to the students enrolled, and past winners have shown great pride in winning the awards. More recently the cooperating fixed base operator has presented awards in the form of additional flying time to five students showing the greatest flying ability.

Onalaska officials are quite confident that after federal monies are no longer available (at the end of the third year), the local school system will continue to conduct a similar type of offering in the curriculum.

It is felt that the experimental stages are over, that the course is feasible, and that school systems throughout the country can benefit from the results and implement a program to suit their economic situation.

As a result of the interest created by the Onalaska program, many high school administrators immediately ask, "How can we get federal funds to initiate a similar program?" The answer, of course, would be that they cannot obtain such funds, since Title III projects are required to be innovative and exemplary. The Onalaska program is designed to determine how to conduct such a course, and there is little need for another school to conduct an experimental program on the same subject.

It is, however, possible for a school to initiate a program without federal aid, as has been demonstrated by the initiation of new courses at Clintonville and Shawano High Schools.

In summary let me point out that I think the greatest opportunity for industrial arts people lies in the area of conducting a course which would train teachers to teach aeronautics courses. Insofar as I know, there are at this time no schools conducting such courses, and surely the school which initiates such a program would be achieving a conspicuous first.

Mr. Guell is Chief of Aviation Education, Madison, Wisconsin.

Th-10.12 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF SLOW LEARNERS
Chm., Hal Birkland; Rec., Ethan Svendsen; Speakers, William Cochran, Frederick Miller; Host, Elmer E. Erber.

STRUCTURED INDIVIDUAL PROJECTS FOR THE MENTALLY HANDICAPPED

William A. Cochran

The methods used in teaching the mentally handicapped are varied, and depend upon the capability of the teacher to analyze and evaluate the ability of each student, the difficulty of the operation or job, and the equipment and materials used in the industrial arts lab-

oratory. The methods used should eliminate judgments on the part of the retarded student by minimizing the thinking and emphasizing the physical manipulation.

One of the major problems in teaching the mentally handicapped student is the lack of motivation. Motivation is no easy task, because these mentally retarded students have experienced years of failure in and out of school, competing with peers or siblings of higher intellectual abilities.

A second major problem in teaching the mentally handicapped is the transfer of learning. Transferring knowledge from one area of learning to another involves abstract thinking, which is often lacking in the mentally retarded student.

Effective teaching is accomplished when the student is ready to learn. The retarded student will achieve much more when he can see a definite use or relationship for the instruction. The teacher must continually provide experiences that are concrete in nature and that place the retarded boy in a position where he wants to achieve.

A fourth problem area which must not be overlooked is that of student attitude. Attitudes such as: (1) Pride in workmanship; (2) self-confidence and self-concept; (3) group participation and cooperation; (4) sense of organization and systematic procedure; (5) ability to follow simple directions which involve some judgment and decisions; and (6) safety and safe practices.

One last point: we as teachers are not trying to develop a creative ability; this is a void in the intellectual make-up of the retarded. We are trying to teach the retarded how to "sweat". Most of the jobs they will enter will involve non-skilled or semi-skilled work. When they leave school they are not judged by IQ, but on performance.

The structured individual project method is an attempt to overcome the lack of motivation and ability to transfer learning. It is an attempt to develop good social and work attitudes, and a readiness to learn. The project becomes the vehicle to bring about these behavioral changes.

The mentally handicapped boy must be confronted with instructional units that have built-in guarantees of success. The teacher must develop "crutches" in order to circumvent the student's limitations. These "crutches", used in the initial phases of instruction, are the same ones used by industry in mass production known as jigs. This project resembles mass production except that each student completes each operation in sequence. Jigs break down the experience into their simplest form, minimizing the thinking and emphasizing the physical manipulation. Like a computer, the student is "programmed".

The structured individual project insures each retarded student as much success as possible and develops a sense of self-assurance.

It has been found that this method works best when the three R's of special education are followed, the three R's being: (1) Repetition, (2) Reinforcement and (3) Routine.

The structured individual project allows for repetition in the sense that the fundamental operations of project number one are repeated in project number two, with the addition of one or two new operations. Repetition in this manner will tend to program the retarded students and yet allow for variety in project construction.

Reinforcement comes about by the structured individual project, in that the projects can be engineered to reinforce what is being taught in the other classes of the school. Following directions, persistence to completion of a task, pride in workmanship, need for safety precautions, care and use of tools and equipment, and respect for property are also reinforced.

To a normal person, routine is something to be avoided, but for the retarded it is something to be desired. They feel secure when they know what is expected of them each day, as long as these expectations are within their scope of limited abilities and interests: Routine in the way that they enter class, put on their aprons and safety goggles, get out their work of the previous day, assemble for instruction or directions. If a set routine is broken, frustration and disorganization result.

Keeping the three R's of special education in mind, the structured individual project should: satisfy a real need; be suited to the class's social, physical and mental level of development; develop desirable habits and attitudes for the acquisition of knowledge and skills; further both individual and group growth by reinforcement of knowledge already acquired in other areas of the school program.

The first project should be very simple, involving not more than three or four operations. An example is a wooden note holder with a pinched clothes pin, an upright piece and a base. The second project could be a small jewelry box. It is essential to repeat the operations of project number one with the addition of several new ones to reinforce the previous knowledge and skill.

From this simple beginning the teacher can structure future projects and lead his "special" class into more difficult operations and into the various areas of the industrial arts. After the retarded students have developed sufficient knowledge and skill, they should then be given an opportunity to construct a project on their own.

This method is based upon the principle of bringing about behavioral changes systematically rather than accidentally, known as Operant Conditioning.

The idea to remember is to keep the projects simple without too many operations in one project.

Mr. Cochran is Shop Supervisor at Mason Occupational Training Center, Arlington, Virginia.

Th-10.14 AIAA
Special Interest Session
NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF INDUSTRIAL ARTS
Chm., Bernard Dutton; Rec., George R. Horton; Speakers, Bruce Hamersley, Cyril W. Johnson; Host, Ronald P. Thomas.

THE "SYSTEMS" APPROACH FOR TECHNOLOGICAL STUDY

Bruce Hamersley

Can we explore some new concepts of learning and thinking which may yield some strategies for teaching industrial arts? First, we must agree that a definite need for exploration and change exists. It is this writer's belief that we must develop a rationale which requires that more emphasis be given the "learning" skills and less involvement with activities of a non-directional manipulative skill development type. I submit that we need a conceptually based approach to the study of our technology. This must represent a continuum of sequenced learning experiences developed by a team of technologically oriented educators so that it will skillfully play an important role in the makeup of the learners' total educational plan at this given moment in the scheme of things. In other words, if the world we live in is seen by the learner as a total thing then we as educators must devise a "system" of meaningful and integrated educational experiences for him or her.

Our "Learning System" should incorporate those inter-related elements which will help to answer the prime questions facing educators: (1) What should be learned? (2) How should it be taught? and (3) Who should teach it? In more concise terms we are asking about the Curriculum, Facilities and the Personnel which will be required for the study of Technology in the school of the 1970's. We are also asking what should the elements that will serve to make up this "Learning System" be? How will industrial arts or the study of technology be affected by or involved with flexible scheduling, mobile staffing, team teaching, independent study, inter-disciplinary or trans-disciplinary curriculum structure, constant re-training or inservice involvement of teachers, individualized instruction, A V V or Multi-media usage, and the ungraded aspect? If we agree that education today needs an organizational pattern for tomorrow, then I will present one such "Learning system" based on the new requirements for curriculum, personnel and facilities.

The program at Drew Middle School was developed by a team of carefully selected "change agents" who were committed to the idea that seven learning planner/directors could establish a technology study which would meet the needs of today's youth. This curriculum design would incorporate those elements which would provide the best possible system, a system which could be evaluated and re-created so as to yield a constantly changing educational environment. The team developed its rationale. The following objectives grew out of our rationale.

INDUSTRIAL TECHNOLOGY at Chas. Drew Middle School will:

1. seek to design and create an educational environment conducive to the investigation of our industrialized society, its nature, its technology and its educational needs.
2. develop and perpetuate ways of acquiring knowledge relative to our discipline and prescribe methods of directing (self-directed) study.
3. describe student experience and achievement in terms of
   a. acquiring and applying technical knowledge and manipulative skill as the evolving problem dictates the need for these practices.
   b. acquiring technical knowledge in-depth in certain specific problem areas and in more general fashion for Creative Arts, Communications, Construction, Manufacturing, and Service Technologies.
   c. stimulating and nurturing curiosity and the inclination of the learner to be involved in searching technological phenomena.
   c. encouraging the learner to develop confidence in his or her ability to solve problems even in the face of initial information voids and difficult abstractions.
   e. contributing to the learner's development as a potential "Creative Thinker."

The structure of our discipline as prescribed by the above stated objectives would look like this.

Level One .... Total curriculum reflecting all of man's knowledge.

HUMANITIES TECHNOLOGIES SCIENCES

Level Two .... A construct for the Technologies . . . at this level the system is developed.

INDUSTRIAL TECHNOLOGY

Level Three .... A conceptual approach based on the study of a continuum of experiences in the realm of Industrial Technology.

This curriculum construct or model is based upon the involvement of the learner in a sequence of experiences which make up a technology (transformable) environment.

Phase A Experimental or Creative Arts Technology
Phase B Communications Technology
Phase C Construction Technology
Phase D Manufacturing Technology
Phase E Service Technology

All of the integral components of this model are woven into being as a total educational environment with the addition of the "System" elements. Team teaching, nongradedness, interdisciplinary learning experiences and flexible scheduling are but a few of the elements which build the relationship of content and method in our system.

Mr. Hamersley teaches Industrial Technology at Charles Drew Middle School, Miami, Fla.

NEW TEACHING TOOLS

Cyril W. Johnson

A teaching tool is any device which, when used in an educational context, does not produce or contribute to the production of items having economic value. Thus, a duplicator or copier, a camera or projector, a tape recorder or record player, and a host of similarly oriented, commercially used items of equipment are fully accepted teaching tools.

Improvement in the design, acceptance and use of teaching tools is the one great hope of education, if it is going to meet the challenges of tomorrow. Mr. H. Walter Shaw, publisher of McGraw-Hill's "Technical Education News," in his editorial in the January, 1968, issue said, "... quick prediction: fewer but better teaching machines ... a spectacular increase in the use of transparencies as a teaching tool ... more effective use of the physical facilities ... greater participation by business and industry in local school affairs ... a continuing movement toward educational systems approach to teaching ... the beginning of educational research with enough foreplanning and coordination to make the results meaningful." The most meaningful of the above predictions are the ones concerning the use of educational systems and educational research, for it is through these approaches that the real promise of education is to be found.

Practically all of the really new tools for education, and specifically, industrial arts education, are to be found within the realm of the "systems" approach. The educational systems approach, simply stated, is a deeply structured multi-media program, which, when properly used, greatly increases the effectiveness of the educational effort. An educational "system" is the result of very extensive planning by a group of specialists who have carefully studied the requirements of the problem, the attributes of the trainees, and the availabilities for the training. This group can then write a program of learning experiences which will enable the students to achieve the course objectives.

High on the list of priorities to such an achievement is (1) the preparation of effective media to aid the student in the learning process, and (2) discovery of the best methods of using these media in the classroom or laboratory. The many industries which are directly involved with the development of training and communications devices are constantly announcing their latest models as something new and better. The writer seriously recommends the careful reading of the April, 1968, issue of School Shop, which is a special issue on "Using the New Media Systems". Other publications of value in understanding more about this subject are: Training in Business and Industry; Visual Communications Instructor; School Product News; and Audio-Visual Education.

At the present time, the optical-photographic (the conventional audio-visual) systems (projectors, films, records) have an outstanding lead over the electronic systems (television, videotape). The existing instructional hardware is largely in the area of optical-photographic tape for pictorial and audio storage and transmission. Photographic information is still superior to electronic, and will probably continue to be so for a period of time. As technical improvements continue, however, electronic storage and transmission or combinations of the electronic-optical and optical photographic will find its way into the school systems.

Closed circuit television and videotape recording are rapidly entering as economically and educationally competitive devices in the schools. The number of manufacturers with devices on the market is amazing, and the fact that the software that is used (tape) is not compatible set-to-set is retarding the rate of acceptance within the school community. Industry-wide standards for educational television systems will have to be established. As the prices drop, more and more installations will be made, and the use and understanding of the medium will improve. Already some systems are less expensive to operate than are the conventional optical-photographic, and the ease, speed and versatility of the electronic system is rapidly showing its superiority for certain applications.

Programmed instruction is continuing to show great potential and some limitations. It can do many things very well, but use has shown that it cannot replace or take the place of a good teacher in the classroom environment. Programmed instruction in the form of books, notebooks and other ways of using printed material without the machine is becoming increasingly available.

The teaching machine has the capability of presenting a complex stimulus—picture, sound, color, as well as words—and on the other, of a complex response mechanism relating the student's response instantaneous to the task at hand. Its use in a teaching-learning situation has not been disputed, but its cost and relative inflexibility has limited its growth. Inevitably, the teaching machine will be linked to computer control.

Real improvement in the devices to project a film has been made. The old, familiar 16mm projector is now self-threading, and capable of multi-speeds, reverse, stop or frame-by-frame presentation. Weight has been reduced to the point where it is truly "portable". Brand new in the projection field is the 8mm, cartridge loading, closed-loop projector. Able to handle silent or sound films, it can be set to operate continuously, once through, or any other combination. Films used can be as short as the three minute "single concept", or as long as ten minutes. Equally useful is the new technique of applying a sound strip alongside the optical track of a 16mm film. Using a magnetic-optical sound projector, the teacher can record his own track, and customize his film to the needs of the classroom without disturbing the optical presentation.

The development of the cassette loading tape has made the use of the tape recorder a very worthwhile teaching device. Self-loading, self-rewinding, automatic shut-off and safety of the tape makes it an excellent device for self-study.

The use of microfilming techniques in the drawing room and study carrel is another relatively new technique. Its use multiplies the effectiveness of the carrel, and greatly simplifies the problems of storage of records and documents.

Complete systems for demonstration and training in the fields of internal combustion engines, power transfers and trains, hydraulics and pneumatics, electricity and

electronics, and jet power are available from a number of manufacturers. Some of these teaching devices are simulators, some are mock-ups with computer print-outs, and some are actual operating machines. All are highly instructive, and will have a place in the training field.

Spectacular advances have been made in overhead projector capabilities and the devices which are used on the light stage – transparencies, motion simulators, meters, etc. Materials and techniques have been developed which enable the individual to make visual aids with professional results.

The systems approach and the use of multi-media in the classroom and laboratory give education an opportunity for a quantum leap in effectiveness. The alert teacher and administrator will not miss this opportunity.

Mr. Johnson is Industrial Arts Chairman, Fairmont State College, West Virginia.

Th-10.15 AIAA
Special Interest Session
<u>NEW CONCEPTS IN LEARNING AND INSTRUCTION APPLIED TO THE TEACHING OF INDUSTRIAL ARTS</u>
Chm., Robert Ryan; Rec., W. R. Miller; Speakers, George Morgan, M. James Bensen, Robert M. George; Host, John R. Swearingen.

TEACHING THROUGH RESEARCH AND EXPERIMENTATION

Robert M. George

"We are facing the question now as we have been for the past few years, as to whether we shall continue to devote our attention to miscellaneous and more or less meaningless projects, or whether we shall seek in an orderly way to develop an insight into the basic industries of our time and a knowledge of some of the steps through which these have reached their present form. . . ." These words are in most respects as true today as they were when written by Charles Richards over sixty years ago. Yesterday's skills, mental or manipulative, are not adequate for tomorrow's occupations. We in industrial arts tend to enclose the student in a teacher-dominated environment with little or no opportunity for problem solving, creativity or self-discovery on the part of the student. We who are firmly committed · democratic practices should find this very distasteful. Industrial arts teachers must p.· .ce and practice a program that does reflect the technology of the industrial areas within which we are involved.

There should be little doubt that our present project-teacher centered programs must become student centered. It is difficult to imagine today's bookcase, plastic gearshift knob or metal vanity stool as different from yesterday's breadboard, tie rack or broom holder.

I believe there are several new programs now being advocated by leaders across the country that hold high promise for the future of industrial arts. One such program, advocated by Dr. Donald Maley at the University of Maryland, is called the research and experimentation concept; I have used this to a very rewarding degree throughout the past two years. The concepts embodied in the research and experimentation approach call for the student to work within the framework of his own interest, being guided by the instructor through a carefully oriented, scientific procedure to a final solution. I believe it to be one of the best thought-stimulating and challenging techniques to which a teacher may expose the student.

The student begins by establishing a problem to work on, and his study becomes an analysis of, an investigation into, or a comparison of his area of interest. His statement of the problem tells what he is trying to accomplish and the statement of purpose gives his reason for doing the study. The statement of need presents implications of the research to society and incorporates reading, contacting recognized authorities and sets the basis

for an accurate and conscientious study. The student hypothesis is a projection of the possible outcome of the research, assumptions are made to cover loopholes in the research or to control those factors over which the researcher has no control and limitations describe the conditions under which the researcher is working. A statement of procedure outlines the steps that are taken to complete the research and all terms and words are identified when necessary, to clarify their meaning and relationship to the study. Finally, the student draws conclusions based on his research that either support or refute the hypothesis, and recommendations are made that may guide the next researcher.

There are several comments that may assist the reader in formulating his own ideas on the concept that I have found useful:

(1) After using this technique with various ability level groups, I find that nearly all ability levels can utilize the technique to some degree of success. There is, however, a higher level of interest and consequently of achievement among the better ability groups. I have found it a way of "unlocking" many students and have been very surprised at the intensity and depth of research activity among supposedly poor students. As several of the students have said, "It's the first time I've ever been able to do serious study on my own that I'm interested in."

(2) The seminar can be utilized to a worthwhile degree in the time leading up to the completion of the research activity. In the seminar session, the student sits down with his classmates, reports his progress and presents his problems. Many times during the seminar, a student's problem was readily answered by another student.

(3) There is little doubt in my mind that a well-equipped general shop, representing a wide range of different machines and testing devices, greatly facilitates the research and experimentation approach.

(4) The teacher must adjust very quickly to the fact that he will not have all the answers to his students' questions, and will find himself in the role of the learner as well. There is little doubt that any student who does a thorough job of a research or experimental activity will know more about that activity than his teacher. This may be a role some teachers will not care to assume.

(5) Teachers must not attempt to dominate the choice of experimental activity. A teacher may wish to concentrate work within the framework of one subject area, and the traditional area of woods alone will provide a great many experimental and research activities.

(6) Some industrial arts people feel that the experimental approach is very limited in scope, that it does not allow widespread use of various equipment or materials. I have not found this to be so. A student will use the saw, welder or press on the experiment as readily as on the project. If the teacher must insist on the project only in order to have the equipment used, it seems highly probable that the project, not the student, is the intended end result of the program.

(7) This program may be considered a separate program as such, a supplemental extra-curricular activity, or incorporated as an option in an existing program.

All would have to agree that modern industry is a product of science and technology, yet we have done very little to make use of these implications in industrial arts. Our field can no longer remain oblivious to the highly automated, computerized society in which the student of today will live. We are at the gateway of a great opportunity. I believe the research and experimentation concept will help industrial arts meet the challenge.

Mr. George is Industrial Arts Instructor at Anamosa Community School, Anamosa, Iowa.

Th-11.3 AIASA

AIASA Session

WHO CAME FIRST, THE TEACHER OR THE STUDENT?

Chm., Samuel L. Powell; Rec., John Moses; Speakers, William Faver, Bill W. Mayes, Sherwin D. Powell, W. A. Mayfield, Bobby Tillman; Hosts, Rudy Cantu, Donald Parker, Don Townsend.

INDUSTRIAL ARTS BEYOND THE CLASSROOM

William Paul Faver

I would like to begin by asking, are you reaping the benefits offered by an industrial arts club? The benefits which can be gained from an industrial arts club are numerous.

Perhaps the most important advantage of an industrial arts club is the interest developed and knowledge gained by students for industrial education. Information concerning modern industry is gained from class and enlarged through additional study at industrial arts club meetings.

Secondly, students who do not receive attention from their parents and families, or who do not participate in other school organizations, may find a place in the industrial arts club which will enable them to obtain this needed attention, as well as a sense of belonging. Some of these students may become leaders of the club. Students who develop this interest and sense of belonging are happier and become more willing to put forth their best effort in class and in club work.

Students acquire a needed lesson by working in harmony with their peers. Not only do students learn to work in harmony with each other, but they develop a working relationship with their industrial arts teachers. This may alleviate many problems which might occur in class because of a lack of understanding between the teacher and student.

Through projects sponsored by the industrial arts club, students learn responsibility. This helps students to become more responsible citizens.

Many important assets of industrial education can be brought to the attention of the public through projects of the industrial arts club. Since many adults do not understand the industrial arts program, this is one way of educating them to the objectives of this program.

If you as a teacher of industrial arts are not taking advantage of the benefits offered by an industrial arts club, then now is the time to begin. Your time and hard work spent will be well rewarded by the growing interest of your students in industrial education.

Mr. Faver is Drafting Instructor at Cypress-Fairbanks High School, Houston, Texas.

Th-11.4 AIAA
Reports of Research
IMPROVING INSTRUCTION
Chm., L. S. Wright; Recorder, Harold H. Bretz, Jr.; Speakers, James J. Mooney, Kermit Anderson, Paul R. Meosky; Host, Roland W. Williams.

PROFESSIONAL CONCEPTS IN TEACHER EDUCATION

James J. Mooney

The professional education of an individual in any profession is complex, whether it is in teacher education or some other learned field. It is the acquisition of knowledge from which concepts are formed associated with the role a person is preparing to assume.

Each industrial arts education program has a theoretical base or rationale for its action which is projected to the student. The student will in turn form concepts, i.e., give meaning to objects, events, or people having common characteristics, through those experiences provided by the program. These concepts are either implicit in the teachings of the industrial arts educator, or implied by the actions being carried on in the education of the student. To find out how well the professional concepts of an industrial arts education program were being projected to the student, a study was conducted at Buffalo State University College in the fall of 1966.

The purpose of the study was to analyze the professional growth of the student relative to professional education courses taken in the baccalaureate program; changes and

direction of change regarding concepts of industrial arts held by the individual as a student and teacher; and the influence of the supervising teacher (secondary school industrial arts teacher) and educator upon the student during his preparation. An instrument consisting of seventy-three professional concepts of industrial arts was developed, to be emphasized in the industrial arts education program at Buffalo State University College. The instrument was validated by "rating by experts" and "test-retest" technique using a "strongly agree – strongly disagree" rating scale.

The instrument was administered to 504 (91.6%) industrial arts majors in the fall semester of 1966-67 school year; 66 industrial arts teachers (74.2%) with one year of teaching experience; and 78 supervising teachers (91.2%). The t test was employed to identify significant difference between total group mean scores obtained by students, teachers, supervising teachers and educators, and between professional education courses taken during the students' preparation. On the basis of these tests, the data indicated professional growth did take place in all but two courses, when it was measured in terms of professional concepts of industrial arts held by students.

The introductory course in the professional preparation of students reflected a significant difference, when compared to scores made by those who did not have the course. The second course regarding human growth and development was not significant; the third course dealing with principles and practices of industrial arts teaching was significant; student teaching was significant; and the final course, designated as a laboratory of industrial arts teaching, was not significant. Changes in terms of mean scores for all courses, except the final course in the professional preparation of the student, was positive when compared to professional concepts held by those already in the profession.

The mean score of industrial arts teachers having one year's experience was significantly different from the industrial arts students'; however, it was a negative difference. Industrial arts supervising teachers' mean score was significantly different when compared to student teachers. The supervising teachers' and student teachers' concepts of industrial arts were also significantly different when compared to industrial arts educators', though the mean score of student teachers was closer to educators than supervisors.

The study indicated professional growth is positive and continuous during students' preparation; supervising teachers do not have as much adverse influence on student teachers as research has implied; students, having completed student teaching, appear to accept professional concepts of industrial arts to a greater degree than supervising teachers, teachers having one year of teaching experience, or industrial arts students in general; student teaching experience does provide positive professional growth towards the professional concepts projected; the teacher having one year of teaching experience appears to be at a stage in which his professional growth does not improve and if anything, slightly regresses, as measured by the instrument used in this study.

The implications indicate that while students do grow in a positive manner in professional concepts of industrial arts, they are not as close to those projected by the industrial arts educator as one would wish. Also, the supervising teacher was not as close in agreement with the educator as desired. Why this was so, when both were directly influenced by the educator, needs to be analyzed and possibly explored beyond this study. It might mean our deeds are not up to what we advocate.

If, as Buffalo State advocates, industrial arts is the study of industrial technology, then the technology must be identified and structured for teaching. Neglecting to do this may cause us to endorse a concept of industrial technology, but by our actions we portray a concept of manual training. As industrial technology becomes the focal point, programs must move to reflect man's ability to change material, a resource, into useful objects rather than be predominantly skill-oriented. Skills such as manipulation of machines, methods such as demonstrations and related lessons may become of less importance.

We might have laboratories centered on manufacturing concepts whereby materials are tested and analyzed and implementation takes place. This would be the education phase of understanding industrial technology, while the training, the operations of machines could be carried out by machines. It's conceivable that we could program demonstrations through films, tapes and computers whereby the best examples, the best questions could be used to inform the student what the machine or operation is all about. It's also conceivable that we could build machine safety features which would stop the student if, after a programmed demonstration, he proceeded incorrectly. We would not remove the mechanical skill aspect of our program, but only place it in its rightful place, i.e., as a means of solving some problem. It seems we cannot continue to project professional

concepts of industrial arts relative to industrial technology while emphasizing, by our actions, concepts which stress mechanical skills.

Buffalo State, in its study of industrial technology, is focusing on manufacturing, communication and power. In addition, a professional semester in the secondary schools is being developed. Hopefully, some of these experiments and changes will cause the professional concepts projected by the educator to be better understood by students and supervising teachers.

Dr. Mooney is Associate Professor at State University College, Buffalo, New York.

SAFETY INSTRUCTION THROUGH CARTOONS

Kermit Peder Anderson

A need is indicated within industrial arts education for more effective methods in the presentation of safety instruction. The caricature or cartoon method – although largely overlooked or untried as an educational medium – does indicate much instructional potential. The complete void of research concerning the effects of these comic materials as a safety instructional medium motivated this experiment in supplementing safety instruction.

The purpose of this study is embodied in its title: "An Experiment to Determine the Effectiveness of Caricature Booklets in Supplementing Conventional Machine Woodworking Safety Instruction". More specifically, this problem involved (1) developing caricature safety booklets, (2) developing measuring instruments, (3) administering the research for the purpose of collecting pertinent data and (4) interpreting the collected data.

Safety booklets and testing instruments were devised for the instruction and measurement of band saw, circular saw, drill press, jointer, surfacer and wood lathe safety units. These materials were subjected to evaluation by a qualified jury, revised, and then submitted to a second qualified jury for re-evaluation.

The study was administered to a cross section of the population within the school districts of Houston and College Station, Texas. Included in the study were nine participating teachers, each teaching an experimental and a control group of beginning machine woodworking students. Data compiled from a total of 291 students were used for statistical comparisons. The teachers presented conventional safety instruction to each group, supplemented the instruction to the experimental group with caricature safety booklets and administered a unit safety test following each unit presentation. A pretest was administered at the beginning of the semester, and a retest was administered three weeks after the last safety unit was presented.

The statistical design of the experiment involved a randomized complete block design, with each group receiving three units of experimental and three units of conventional instruction. The analysis of variance with interaction was used for statistically analyzing the data. Measurements of initial learning and retention of safety instruction were analyzed for all six woodworking machine safety units.

Comparisons measuring initial learning indicated (1) a treatment effect, wherein the experimental treatment was significantly better at the 0.05 level of confidence, for the drill press, jointer and surfacer units; (2) a significant difference between teachers in all initial learning comparisons; and (3) a teacher by treatment interaction in all but the drill press and jointer units.

Comparisons measuring retention resulted in (1) significant difference between treatments for the drill press, jointer and wood lathe units, wherein the experimental method was better at the 0.05 level of confidence; (2) a significant difference between teachers for all units with the exception of the circular saw and drill press units; and (3) a significant teacher by treatment interaction occurring within the band saw, surfacer and wood lathe units.

The statistical analysis of the data utilized within this research indicated a significant variation of teacher, treatment and teacher by treatment effects. More specifically, the results of this study indicated the following conclusion; conventional safety instruction supplemented with the caricature safety booklets will result in greater initial learning and retention of safety instruction than that measured using only the conventional method of

safety presentation.

Additional generalizations have been developed through a combination of these analyses, through the administration of a questionnaire to the participating teachers, and from informal observations and conversations. They are as follows:

(1) The teachers plan continued usage of the caricature safety booklets because each booklet is readily accepted by their classes, and its contents are beneficial in the supplementation of their safety presentations.

(2) The students enjoy the caricature safety booklet method of safety supplementation and benefit from its content.

(3) The teachers utilize various instructional methods in presenting safety instruction, possess varying attitudes toward its importance, and obtain varying degrees of success through their instructional results.

This study has demonstrated a safety presentation technique that is unique to the field of industrial arts. Through this research, including the review of literature and the findings of this study, various questions arise that may potentially indicate issues of importance for future consideration in the field of industrial arts. These recommendations are as follows:

(1) Research should be conducted similar to this study with utilization of a different statistical design.

(2) Studies should be conducted comparing the presentation of caricature safety booklets specifically with another method (or other methods), such as safety rules listed within a given textbook versus this caricature safety presentation.

(3) Investigations should be conducted to determine the potentials of increased desirable safety attitudes, instilled within the student, through the use of caricature safety booklet supplementations versus the conventional presentation.

(4) Research should be conducted employing cartoon materials within other areas of the industrial arts.

(5) Investigations should be conducted to establish what safety attitudes and practices exist, and which are retained by the industrial arts student.

(6) Studies should be conducted comparing the effectiveness of bulletin board safety materials in influencing student attitudes and awareness of safety precautions.

(7) Comparisons should be made between safety instructions and attitudes, as instilled and retained in industry, with those presented and retained within the industrial arts laboratory. Should this comparison indicate a significant difference, further investigation should be conducted in establishing which method is more successful in the development of desirable safety attitudes and practices within the age group considered.

Dr. Anderson is Assistant Professor at Bemidji State College, Bemidji, Minnesota.

PERSONALITY AND TEACHING SUCCESS IN SECONDARY SCHOOLS

Paul R. Meosky

Teacher education today is faced with the tremendous problem of selecting from among the candidates for the teaching profession those students who will later be successful as teachers. One facet of this problem is the determination of the personal qualities necessary for success in teaching. Research in this area has been mostly concerned with the over-all view of successful teaching at all levels of education.

Since the beginning of this century, investigators have sought to determine reasons for success or failure among teachers. The study by J. B. Morgan in 1961 showed that differentiation between most successful and least successful industrial arts teachers could be accomplished by use of a personality testing instrument.

The evidence in the literature indicates that personality is an important variable affecting teaching success. Only a few studies have been found in the field of industrial arts concerning personality and teaching success. This study was undertaken to investigate the relationship between the personality factors of secondary school industrial arts

teachers and their success in teaching, as indicated by principals' and industrial arts supervisors' ratings. The teachers were administered Cattell's Sixteen Personality Factor Questionnaire, and the principals and supervisors completed a rating instrument devised by Dr. J. B. Morgan of Colorado State College. The rating instrument contained twelve traits which were considered to be most important in measuring teaching success in industrial arts. These rating scales were used to determine the most successful and the least successful teachers.

The population for this study consisted of all graduates of the Industrial Arts Department of Trenton State College during the four-year period, 1962-65, who were teaching in the public schools at the secondary level in New Jersey.

In a comparison of the t-tests on the means of the Sixteen Personality Factor Questionnaire variables for most successful and least successful teachers, it was found that no variable had a t-score significant at the 5 percent level. The most successful teachers would seem to have no personality variables different from the least successful ones. Therefore, it seems questionable whether the Sixteen Personality Factor Questionnaire will differentiate between the most successful and the least successful teachers by the use of the t-test and mean scores of the sixteen personality factors.

The principal and supervisor rankings of the personality factors were analyzed in testing for significance by using the Spearman Rho formula of rank-difference coefficient of correlation. Since the amount of correlation between the two sets of scores proved to be insignificant, the hypothesis that no significant differences exist between principal and supervisor rankings must be accepted. Personality factors ranked in order of importance by both principals and supervisors thus tend to be closely associated.

Spearman's Rho was also used to test the hypothesis that there are no significant differences between the rankings of the factors of age, teaching experience, final collegiate grade point average, or School and College Ability Tests - Scholastic Aptitude Test scores of the total group of industrial arts teachers who were rated by principals and the total group who were rated by industrial arts supervisors. Since no variable differed by more than two ranks, the variables would seem to be held in equal importance, at least in the order of their rankings, by both principal ratings and supervisor ratings.

In order to compare the sixteen personality factors between the groups of most successful and least successful teachers, the F values for each factor were checked for significance. Only four F values were found to be insignificant for the group of most successful teachers and two for the least successful group. There were no insignificant factors which proved to be similar for both groups.

In summarizing the analysis of data, a description of the group mean scores on the Sixteen Personality Factor Questionnaire can be determined. Inasmuch as no significant difference was shown between the top third of the group (rated most successful) and the bottom third (rated least successful), it may be assumed that any group differences in scores on the sixteen personality factors could have happened by chance and the variable of teacher-rated success does not influence the characteristics measured by the personality test. However, a description of the personality profile for the entire group can be made.

The total group measures deviant from average on only four of the sixteen factors. The factor measuring scholastic mental capacity shows the group to measure two sten scores above average. This is to be expected in a college graduate population.

The second factor measuring away from average is that of zest for living. The total group measures below the average population norms which are above average. This group is evidently generally less enthusiastic and more subject to general depression than average.

The third factor which seems to distinguish this group from the average normative population measures the ability to behave according to one's idea of proper behavior and this group measures with above average control.

The fourth factor shows this group with the ability to accept responsibility without rigidity. The rest of the factors show average and tell us very little about the group except that they display a low average ability and interest in relating to people, a high average ability to withstand pressure and not become upset, a low average ability in aggression and dominance tending toward conformity, a high average spontaneity, a low average score showing a tendency toward being realistic rather than idealistic, a high average tendency toward being more suspicious than trusting of people, a high average score showing a tendency toward creativity, and a low average score showing a tendency toward being forthright rather than shrewd. The group measures high average in analytical thinking,

self-sufficiency and tension.

The above mentioned profile factors are only valid for the group of industrial arts teachers that took part in the study.

Dr. Meosky is Professor of Industrial Arts at Buffalo State University College, Buffalo, New York.

11.4.3 AIAA
Reports of Research
VIDEO TAPED MICRO-TEACHING
Chm., Lee Smalley; Rec., Donald Haberman; Speaker, Harlyn Misfeldt; Host, William R. Biggam.

VIDEO-TAPED MICRO-TEACHING

Harlyn T. Misfeldt

The American Industry Project, unhampered in its development of new departures in its teacher education program at Stout State University, has made good use of a teacher training approach pioneered by Bush and Allen of Stanford University. Micro-teaching is a scaled-down exercise in teaching whereby the student is required to teach brief five-minute lessons to a group of four junior or senior high school students. The purpose of micro-teaching is to provide an opportunity for the future teacher to obtain a substantial amount of practice preceding his entrance into student teaching, under optimum control and evaluation conditions for the trainee, without jeopardizing the learning of the students.

The obvious advantages of micro-teaching include the opportunity for the trainee to obtain substantial practice and self-confidence prior to student teaching. However, there are several other advantages that merit consideration:

(1) Micro-teaching provides an opportunity for the trainee to work on specific aspects of teaching, rather than expecting him to become relatively competent in all of the skills during his student teaching experience.

(2) The short controlled micro-lesson would appear to be a much more appropriate experience for the beginner than being thrust into an hour-long presentation to a complete class.

(3) Micro-teaching permits greater control over practice in terms of the variety of students, physical facilities and lesson content.

(4) Micro-teaching makes possible variations in the amount of practice in terms of the needs of the trainee.

(5) Micro-teaching increases the amount of meaningful practice possible within a limited amount of time, and makes the time and location more convenient for the staff.

(6) Micro-teaching permits several people to evaluate and re-evaluate a teaching performance, and provides the opportunity to keep good records of teaching performance under controlled conditions at periodic intervals.

Scheduling formats

All time and cost figures for the following scheduling formats are based on these assumptions:

(1) A professor's salary of \$10,000 per year.
(2) A work-study student's salary of \$1.50 per hour.
(3) A micro-class of four students with each student being paid \$1.00 per hour.
(4) The micro-teaching session defined as a five-minute teach, a critique, a lesson revision, a five-minute re-teach to a different class and another critique.

When using format number one, the typical micro-teaching sequence for each teacher trainee lasts approximately forty-five minutes. The trainee presents a five-minute lesson which is videotaped. During the next ten minutes, parts or all of the lesson may be played back for the trainee and the supervisor, providing the opportunity for immediate feedback. Following this critique period, the trainee has approximately fifteen minutes to revise

his lesson. The lesson is recorded again, played back and critiqued. The teacher trainee teaches to a different group of students each time and receives feedback from the students in the form of ratings or comments. While trainee number one is revising his lesson and preparing for the next session, trainee number two is presenting his lesson and critiquing his performance with the supervising professor.

The cost of operating with format number one is $5.47 per teacher trainee per session. If this format is used with a capable work-study student doing the recording and [illegible] ing, the cost per trainee is reduced to $?.75 per session. The cost per trainee [illegible] ion can be further reduced to $.75 if a capable work-study student does the reco[illegible], and critiquing and if the micro-teaching is done in a local high school during the day, utilizing unpaid micro-class students from the study hall on a voluntary basis.

When using format number two, the teacher trainees teach in the evening, are critiqued the next day, revise their lesson, re-teach to a different group of students on another evening, and are critiqued the following day. A continuous schedule of five-minute teach sessions is scheduled in the evening with two minutes between each lesson to facilitate the movement of teachers and instructional materials. After every fifth teach session there is a ten-minute break, allowing the work-study person operating the VTR to change tapes and prepare for the next group of five teachers. This break also allows the micro-class students to have a short stretch. On the following day the professor spends approximately fifteen minutes critiquing each lesson with the trainee. The lesson is then revised and the same scheduling format is repeated for the re-teach session. The cost of operating with format number two is $5 17 per trainee per session. As with format number one, a substantial cost reduction can be made by utilizing work study students for critiquing and unpaid micro-class students on a voluntary basis. An almost infinite number of variations is possible with these basic formats to fit almost any situation or need. For example, it may be desirable to have work-study students do part of the critiquing and the professor do part of the critiquing. This compromise would cut the micro-teaching cost and still allow the professor to have input into a substantial number of micro-teaching sessions. Another variation could include a work-study student with one video-tape recorder recording a continuous schedule of five-minute lessons and two or more professors taking the tapes after each half-hour or hour and providing the critique session with another video-tape recorder in another location. This schedule would require more equipment, but would cut staff cost, make efficient use of the micro-class, and still provide almost immediate feedback.

Probably the most important point about scheduling formats is that we must not be bound by a particular format just because somebody else developed it and found that it worked out well in his situation. The more realistic approach is to determine needs, available staff and budget, then develop a schedule that will best meet these needs with the available resources.

<u>Video taping equipment and room set-up</u>

In terms of quality, cost and versatility, a parallel can probably be drawn between audio tape and video tape recording equipment. Not too long ago an audio tape recorder was relatively expensive, and was portable only if you happened to have six men and a boy to help move it about. Presently audio tape recorders are relatively inexpensive and truly portable. This trend is already apparent in video tape recording equipment and we can probably expect to see further reductions in price, greater portability and greater dependability. In the most common room set-up, the video tape recorder, monitor and camera are placed behind the students with a microphone for the teacher and a microphone for the students. With this set-up the viewer gets an excellent picture of the teacher but very little student reaction. An alternate set-up places a camera in a front corner of the room aimed at the students and the VTR, two monitors, [illegible] switcher and another camera are placed behind the students with a microphone for th[illegible] [illegible]er and a microphone for the students. This set-up has the obvious advantage of being [illegible] to tape either the [illegible] or the students and the disadvantage of being more expensive. An appro[illegible] compromise between the one and two camera set-up might be to place just one cam[illegible] side of the room d[illegible]d at both the teacher and the students and add a wide-angle lens.

*Mr. Misfeldt is with Stout State University, Menomonie, Wisconsin.

SPACE AGE TECHNOLOGY

Ernest G. Berger

Man is experiencing one of the most exciting eras of his creation. The scientific achievements and technological advancements of the past decade have been nothing short of fantastic. These advancements are based on man's ability to transform his environment (and indeed himself), and by so doing to enjoy the highest form of technical culture the world has ever known.

It is generally agreed that these rapid advances in space age technology have posed serious problems at all levels of education. Our traditional education appears to be inadequate to cope with the dynamic changes that are taking place in our present society. By the time the children of today's space age assume their roles in adult society, they will encounter an entirely "new" age, and they must be prepared to cope with it.

In our brief encounter last summer with the realities of space age technology and its possible curricular implications for industrial arts, we found that space technology could provide a comprehensive approach to a kind of educational program that is geared to the world of tomorrow. During our institute we saw a great wealth of new and fascinating space age materials of interest to students through which we can enrich our present programs. Space technology opens up a whole new world of materials, content, methodology and direction for a really modern curriculum in industrial arts.

The technical literature published in this country in any 24-hour period is enough to fill a Volkswagen bus. A staggering amount of this information is flowing down from research sponsored by NASA at its centers, and from contracts and grants to universities and private industry. We have been able to utilize many of these NASA documents as resource materials. The NASA Bulletin "Industrial Arts and Space Technology", written by a group of industrial arts educators in May, 1966, was informally field-tested by us during our 1967 Institute. We found it to be a very usable document for upgrading existing programs. The "Cumulative Index to NASA Technical Briefs" proved to be an equally important document and particularly well suited to a senior high program in research and development. A third document, "Space: The New Frontier", is a comprehensive study of the space industry and is presently being used as an industrial arts textbook in one of the Georgia schools. If some of the NASA materials were integrated into industrial arts, interest and enthusiasm for our programs would greatly increase.

When you visit the Kennedy Space Center, or the Marshall Space Center Research Laboratories, or the Oak Ridge National Laboratories, you leave with the distinct impression that somewhere along the line, our programs have slipped at least 20-40 years. During the field trips we saw new fabricating methods and techniques like explosive forming, electromagnetic forming, frangible tubing and honeycombing; observed the uses of new materials such as mylar and teflon; and saw mercury cells, silver cells and sodium and sulfur fuel cells in operation.

From the space program comes new and exciting instructional methodology in the form of research and development, brainstorming, in-depth studies, junior engineering and team activities. The implications of research and development for industrial arts (not to be confused with Maley's research and experimentation approach) proved to be tremendous. The institute staff and participants had an opportunity to experiment with this methodology and to analyze it first-hand as an instructional tool. We found it afforded an excellent avenue through which to achieve many institute objectives.

Another spin-off from the institute was the development of many innovative "Units of Study". These units were designed to create greater interest and enthusiasm in industrial arts programs by the injection of space-age information and technologies. In the area of R & D output, the participants produced working models of such technical "hardware" as cubes of memory thermoplastics, fuel cells, an arc-jet plasma propulsion motor, a thermal motor and copper-oxide rectifiers. Many of these innovative programs

have already been introduced by our participants into their own school systems across the nation.

We also made maximum use of many of the newer education technologies in our institute. For example, we introduced the participants to Computer-Assisted Instruction (CAI) and its adaptation for industrial arts programs.

The space age involves a great deal of technology and engineering of all types. The lag between technological innovations and the human ability and tendency to deal with them constructively has been voiced over the years. This technological lag is generally ignored in industrial arts.

We found that the aerospace industry provides an exciting new body of knowledge which could serve as a basis for a new industrial arts program. We see a great need for something more than merely streamlining or redesigning our present programs. Let us recognize that the thing of which I am speaking is not just a matter of bringing a program up to date or giving it a general face-lifting. Adding a rocket or satellite to a bookend still leaves a bookend, any way you look at it.

The re-evaluation I would propose is far more sweeping. It involves completely new concepts, approaches, techniques and adds the systems approach to industrial arts education. It would drastically alter the philosophy, structure, content, methodology and direction of our present programs. It would require an entirely new mode of thought that envisions classes involved in real-life technical problem-solving situations as well as small groups of students working in competitive teams in the new areas of materials testing, in-depth studies, junior engineering and research and development activities. I think you would agree that space technology could make a significant contribution to our programs because it reflects and represents our technological culture so well.

Ask yourself these questions: Have you looked closely at your industrial arts program lately? Do you like what you see? Are you happy with your image in the American educational system? Would you like to change? What are you going to do about it?

Mr. Berger is Assistant Professor at Florida State University, Tallahassee.

Th-11.5.2 AIAA
NDEA Institute Report
CURRICULUM INNOVATION IN INDUSTRIAL ARTS
Chm., Harold PaDelford; Rec., Leland White; Speakers, Howard R. Schramm, Raymond W. Carrell; Host, Elden Brandt.

INSTITUTE-INSPIRED CHANGES

Howard R. Schramm

At the Ohio State University I was taught the traditional approach by the late Dr. Robert E. Smith and the visionary and new curriculum outlook by Dr. William E. Warner.

Currently and hopefully industrial arts is on the threshold of a new and dramatic revolution, and elaborately-designed programs and materials will soon flood our profession The institute enabled me carefully and critically to examine and evaluate many of the new innovations. Industrial arts must change or perish.

Many in industrial arts are strongly opposed to this kaleidoscopic change and look on many of the new programs as a collection of idealistic and impractical philosophical ramblings.

One of the distasteful aspects of current change in educational practice is its "bandwagon" character. Many industrial arts teachers get excited about new "ideas" they call innovations and want to adopt them immediately for publicity's sake without the searching and thinking necessary to evaluate them in relation to the whole curriculum. We often see piecemeal, unrelated series of changes which look fine on the surface, but are never fully integrated into a coherent, consistent educational whole.

'lastics technology

As one outcome of the institute, it is my ambition to develop a prime plas[illegible] pro-ram. There are few that doubt the vastness and importance of the plastics industry. This ndustry has indeed a brigh. and promising future.

I had hoped to start this program in February of this year. Equipment and supplies vere ordered but a 5-mill operating levy failed in November, again in December, but was assed in March. However, we will not receive this needed money until 1969.

This experience reaffirms my belief that the major problems of the schools today ave their .ots in one basic problem – financing.

.aminating

Although I have been aware of wood laminating for years, it has never been a part f my program.

My being introduced to this process at the institute was responsible for the incorpora-ion of wood laminating into my program this year with much success.

This area will definitely be expanded and improved upon in succeeding school years.

:reativity

As far as we know, Maple Heights is the only school system in the United States to ave a creativity course – one class in each of our junior high schools on the eighth grade evel and one class in the eleventh grade. This program is funded federally, and a recent rant of $31,000 will continue our classes in creativity next year.

During the spring of 1967 the Torrance Test of Creative Thinking was administered o our entire eighth grade of over 300. After further evaluation, twenty students (10 boys nd 10 girls) were selected to participate in this course. The two main objectives of the ourse were to develop the existing creative abilities and to teach creative thinking methods which would apply to everyday life.

Mr. Robert Margraf, an English teacher, was selected to develop and teach this ourse. This coincides with Dr. Ernest Minelli's research findings that English teachers re the most creative.

Although very few industrial arts programs have truly emphasized it, creative think-ng and problem-solving have long been two of our long-range objectives.

Feeling strongly and sincerely that industrial arts could contribute to this course, I olunteered my services, which were accepted. Fortunately, I had a planning period the ame period this class met.

I worked with Mr. Margraf during the fourth grading period and had his class in the ndustrial arts laboratory the fifth grading period. This was the first time I had teamed vith an academic teacher or had an English teacher in the laboratory.

The laboratory project represented a small but important part of the course since : helped the student see the development of a practical and concrete object which pre-iously existed only in his imagination. It was a group project which provided an oppor-unity for the students to use all of the creative thinking methods learned during the first alf of the course. For example, the name of the product, Message Minder, was selected rom over 150 ideas given during a thirty-minute brainstorming session. Designing the roduct allowed the student to use attribute listing, check listing and other creative think-ng techniques. In addition to designing the Message Minder the class also created a name or the company, sold stock, wrote ads, designed and produced a container, a trademark nd sketched posters.

Line production techniques were utilized in the manufacture of the product. Various epartments, such as plastics, frames, etc., were organized with unit leaders. Jigs and ixtures needed to facilitate production were designed and made by members of the class. 'he nature and problems of our American industry and technology were stressed.

This was a highly developed line production project, but the mixed group and the stu-ents highly trained in creativity and problem-solving made it unique. Hopefully industrial rts can contribute to this program next year.

This experience has also been invaluable in helping me to infuse these learned tech-iques of creativity and problem-solving into my classes.

Next year, our system will initiate a training program in creativity for all of our eachers.

ntegrated industry

As an outgrowth of the institute, I have tried to weave or integrate more about indus-

try and technology into our curriculum. In the future I would like to do this more effectively with my special group of slow learners and my class of industrial arts for girls

I have used a line production project in various forms for many years, but this is not the total answer.

We have endeavored to add industrial-arts-related titles to our library.

It was gratifying that industrial arts was included in the "21st Century" series on CBS television. I have used this material with my classes with some success. This one on "New Industries", March 31, 1968, was especially

In order to make students more aware of industry in our community and in the Cleveland area, I had one class of 7th graders place flags on a map to show where their fathers worked. We also located all industries in Maple Heights. Some of the boys also told about where their fathers worked and the nature of their work. I feel that this idea has possibilities.

Materials testing

The institute introduced to me the vast possibilities of materials processing and testing in our laboratories as we strive to change the emphasis of industrial arts.

I have tried to incorporate testing, such as strength of materials and moisture content tests, into my program, and plan to do more in the future.

I have started to collect and use more materials and aids representative of modern industry.

This institute accelerated interest, prompted me to attend a two-day Materials Seminar co-sponsored by Kent State University's Department of Industrial Arts and Technology, and the American Society of Metals. (Incidentally, the ASM is planning to change its name to the American Society of Materials.)

I also plan to use the NASA "Industrial Arts and Space Technology" curriculum enrichment program. It is most encouraging that industrial arts has been included in this program. This publication will be released by the US Government Printing Office at the end of this month.

Overhead

I have always used films, filmstrips, slides, the tape recorder and other teaching aids, but must admit that I have been weak in the use of the overhead projector. I requested that our principal purchase one for our department.

I called the Cleveland 3M representative about overhead transparencies, which resulted in his selling a Thermofax machine to our junior high. He also conducted a two session workshop on overheads for our faculty.

A group of students designed and built a combination stand-and-storage case for the overhead projector incorporating storage for the transparencies.

Fortunately, I have been able to develop and use more transparencies this year and hope to add to and improve what I have in the future.

Change our total program

I have received a rather cool response from some industrial arts teachers in trying to reorient our currently-static industrial arts curriculum; teachers must first sense need for change. If they are satisfied doing things as they have always done them, no new idea, no matter how significant, will elicit any effective response. Change must be initiated by the teachers themselves, once they have defined the need and have strongly felt it.

A wise, interested, understanding and cooperative principal is also needed to initiate change. We took our principal to a presentation of the Stout State University American Industry Project. We also had the opportunity to observe certain phases of this project in the laboratory and to talk to some of the boys involved. Our principal felt that this was an excellent course for this school, but doubted its value in our junior high school. He further believed that certain aspects of this project were already in our industrial arts curriculum and that we could use certain aspects of this curriculum.

Another important ingredient for changing curriculum is a superintendent who is receptive to innovation, who dares to try something new and who has confidence in his teachers' abilities to initiate and implement change. Fortunately, we have such a superintendent.

Quality progress is made in small steps, and I definitely feel that my first steps were directed greatly by my participation in the 1967 NDEA Institute.

Mr. Schramm is Industrial Arts Chairman at East Junior High School, Maple Heights, Ohio.

.hm., Arthur J. Rosser; Rec., E. Ray Johnson; Speakers, Donald Darrow, John E. Collins, Vern M. Bonar;
ost, Joseph Pucel.

AN EXPERIMENT IN MANUFACTURING

John Edward Collins

Let me give you a very brief look at the community in which I am employed. Birming-am is a suburb of Detroit, Michigan, and a high percentage of the residents is involved irectly with the automobile industry or in supporting industries. Most of the students ave been on a guided tour of an automobile assembly plant before junior high chool.

If you were to ask these junior high students what industry is, they would describe a ery large factory filled with noisy machinery, assembly lines, and smoke-filled air. The nly employees they have seen are the mach operators and assembly line workers. ndustry to them is a group of blue collar workers producing a particular product, and they ope they never have the misfortune of ending up in industry.

These junior high students have seen only half the picture. They did not see any of ne engineering, research, sales, personnel or management people at work.

When I returned to school in the fall after completing the NDEA Institute, I decided o adapt some of the material to my own particular situation. The program in Birming-am calls for only ten weeks in the lab, so I had to condense and even eliminate some of ne material. In designing this "Experiment in Manufacturing", the main thought that uided my actions was, "They are going to get the total picture of industry."

The classes involved were eighth grade, and, except for a few transfer students, they ad had ten weeks of mechanical drawing and ten weeks in the materials lab as seventh raders.

The first class meeting was spent in discussing the structure of a typical i trial rts class. I explained that the past approach had been to give a series of demon ns, o select individual projects and to determine grades by project results and test scores. then offered them a second possibility which I called, "The Experiment in Manufactur-ng". They were told in the very beginning that they would have to make a financial invest-nent, and that there was no guarantee that they would get a return on their investment. In act, there was a chance they could lose it all. The result was that in all cases the class elected the Experiment in Manufacturing approach. So in the beginning the students elected the new approach.

Each class formed a corporation and elected a board of directors. Each corporation ad stock certificates printed, and the members of the class could purchase up to one ollar's worth of stock. The board of directors set up a line and staff organization, and ach member of the class was placed in one of the following departments: (1) Finance, 2) Purchasing, (3) Research, (4) Engineering, (5) Personnel, (6) Production, (7) Quality ontrol and (8) Sales. This sounds like the Junior Achievement approach, but Junior chievement, to me, is putting candy which someone else made into glass jars which omeone else made. With the equipment and facilities with which we operate, this is where ne similarity ends.

At the beginning of each class period each department would report its progress. here was some work that had to be done outside school. The people in finance opened checking account with a local bank to handle the money. The people in purchasing had o find sources for material. The research and sales people ran a market analysis to etermine what type of product would be marketable. The final product was usually a ompromise between what the sales department said would sell and what the engineering epartment said we could produce.

Once the product had been decided upon, the engineering department had to come up ith working drawings not only for the product but for all necessary jigs and fixtures. low charts were drawn up and the assembly line laid out for the least amount of wasted notion. The personnel department made out job application forms and posted job open-ngs. Each member of the class was interviewed and assigned some type of production

job. Each student had to wear two hats: he was on the management and the productic teams.

Once we started production we would have a brief meeting before going to worl to discuss how we could increase the number of units per hour. In all cases the numbe would double in three days or fewer.

During the course I invited two outside speakers into the classroom. A representa tive from a stock brokerage firm and a banker explained how their services helpe manufacturing. I made the mistake of having them come in during the productic ins They were both excellent speakers, but the students resented the time lost from prcdu ioi

I would like to close by giving you some of the results of this Experiment in Manu facturing. Once the class saw that the product would be salable and orders started com ing in, the value of the stock would climb. The average dividend paid on one dollar' worth of stock was somewhere between three and four dollars. Students were constantl bartering with each other to buy and sell stock.

It was interesting to see how much more interest and enthusiasm the students ha when there was a chance they could lose their own money. Any student who "goofed-off was severely criticized by the group. Some students who were not enrolled in industri arts asked if they could purchase stock. Each new group of students coming into the de partment now asks if their group will be able to form a company and manufacture a produc

Mr. Collins teaches Industrial Arts at Barhum Junior High School, Birmingham, Michigan.

Th-11.5.4 AIAA
NDEA Institute Reports
INDUSTRIAL ARTS LEADERSHIP
Chm., Joseph J. Littrell; Rec., Lyle M. Faurot; Speakers, Jack E. Lain, Thomas J. Barber, James L. Perril Joseph J. Littrell; Host, Hugo J. Fiora.

A STUDENT RESOURCE CENTER

James L. Perri

The Industrial Arts Department at "South" has for its slogan, "The Department th does things". On the surface this may indicate little, if any, relationship between educa tional needs of students and a department that is active. Actually, this slogan indicates willingness to use contemporary methods of teaching in an attempt to answer student needs.

Contemporary methods of teaching do much toward meeting educational qualificatior of all individuals. However, if contemporary methods are to be used most effectively this department, a student resource center is needed.

The use of limited and traditional resources is but a reflection of the static nature far too many subject-centered industrial arts offerings. The development of the huma potential is dependent upon the permissive nature of the environment in which behavior change takes place and the importance of such changes depends upon the degree to whic the individual conceives, interprets and accepts his own beliefs as they relate to sour attitudes, habits and values. It is only through the flexibility of opportunities to use ur limited resources that a realistic approach to the needs of the individual can be made.(

The purpose of a student resource center for the department would be:

(1) To develop human potential under environmental conditions that would insure th learner the opportunities to explore new and different avenues of understandir and appreciation of today's complex industrial technical society.
(2) To help plan learning experiences that involve problem-solving abilities.
(3) To allow the more able and ambitious student the opportunity of additional ex periences through research and experimentation.
(4) To allow the student who has been infrequent in attendance a greater opportunit to learn specific information and some knowledge of the skills he has missec

(5) To act as a communication center.

In order that a student resource center become a reality, it is proposed that:

(1) A separate room adjacent to the present industrial arts area be made available to house such a center.
(2) The room be no smaller than 576 square feet.
(3) The administration secure a para-professional or a teacher's aide to be assigned to the center under the direction of the head of the department.
(4) Several suitable student assistants be assigned to the center.
(5) The center be designed as a multi-purpose room with facilities for research and planning, audio-visual presentations and small group discussions and demonstrations.
(6) The center have audio-visual presentations for both small group and individual use with tapes and recorders, transparencies and slides, single-concept films, three dimensional mock-ups, spirit duplicator, auto-instructional devices (teaching machines) and television sender and receiver for a closed-circuit unit.
(7) The center have a technical drawing and sketching section.
(8) The center have ample storage and display units for magazines, catalogs, trade journals, bulletins and books and occupational guidance material.
(9) The center be a communication organ for all school communication that deals with teacher or student.
(10) Future closed-circuit television originating from within or without the department be facilitated through the center.

Be it further proposed that teachers:

(1) Make available to the center outlines for units of study and a copy of their daily lesson plans.
(2) Allow a tape to be made of each formal lecture presentation.
(3) Become key source people and spend time in the resource center frequently.
(4) Encourage the more able student to use the center as a focal point for research and technical writing and planning.
(5) Allow those students who have been out of school the opportunity to spend class time in the center to help gain informational content that they have missed.

Plan of operation

First year. The administration would be requested to assign a room for the center adjacent to the industrial arts department. A para-professional or teacher's aide with several student assistants would staff the center. Until the center is funded at the end of the first year, the department or members of the department could furnish some of the equipment, such as a typewriter, drawing equipment and supplies, portable tape recorder and models and mock-ups. Teachers would be asked to locate all materials, other than those they were currently using, such as magazines, catalogs, trade journals and transparencies in the center. The cooperation of the library and the audio-visual department would be actively solicited and encouraged for materials and equipment on loan.

Second Year. Purchase of seven portable tape recorders, one for each teacher to have in his classroom to tape his lectures, would be needed for use in the center, equipped with earphones for student use in either small groups or for make-up work by single students who have missed lectures. A slide projector, a wall screen and an overhead projector would also be budgeted in the second year. Two or three planning desks with facilities to make transparencies and a spirit duplicator would be provided. Additional reference materials, in the form of books, pamphlets, magazines, slides and filmstrips, would be requested.

Third Year. Single-concept films and simple auto-instructional machines would be scheduled for this period. Each area would be responsible for building at least one such machine in addition to those purchased. Facilities for closed circuit television with video tape would be installed during this time. Teacher demonstrations would then be filmed and presented later to groups or individuals.

Conclusion

The subject matter of all industrial arts courses is important, but the fact remains that courses are not taught: It is the individual who is taught, and it is he who learns, inquires, investigates, experiments and arrives at his own decisions based on his learning experiences.

A resource center such as the one proposed here would give more meaningful learning

experiences to students at all levels of ability, instruction would become more individualized, and the development of human potential would be greater.

FOOTNOTE

1. G. Wesley Ketcham, "What Resources Are Necessary or Desirable to Insure to the Learner New Vistas, New Mastery, and New Avenues of Growth", Developing Human Potential Through Industrial Arts, AIAA Convention Proceedings, Tulsa, Oklahoma, 1965, pg. 71.

Mr. Perrill is Head of the Industrial Arts Department, South Mountain High School, Phoenix, Arizona.

THE TEAM APPROACH: JOURNALISM AND GRAPHIC ARTS

Thomas J. Barbe

It is not at all unusual for a graphic arts laboratory to be involved with the printing of the school newspaper, literary magazine or any other school production item. However, it is quite unusual for the journalism or newspaper class to be involved in the manipulative end of the school publications.

This study, to integrate journalism and graphic arts, came about during a summer institute at Arizona State University. The overall purpose of the proposal was to help students acquire a better understanding of the functions of journalism and graphic arts education, as well as some knowledge of the origins, and thus help develop for the student an awareness and appreciation of the vital role which journalism and graphic arts play in our society today.

It is somewhat apparent that there is a complete divorce between graphic arts education and journalism, or newspaper production as it is frequently termed on the high school level. The respective subject areas of graphic arts and journalism are structured in such a way that students are not presented with the enrichment of the production experience which would result from becoming involved in both graphic arts and journalism. The journalism curriculum reviewed indicated that the structure is primarily on the editorial approach; the entire course is devoted to writing articles for the school newspaper publication. The articles are then passed on to the school graphic arts department, or to a local printing firm. In both cases the printing is independent of the writing. At no time has the student become completely involved in the actual educational process and production of this school publication.

In keeping with the stated purpose, to give students the better understanding of the functions of graphic arts education in journalism, it was proposed to establish a class which would involve the journalism and graphic arts instructors in a team approach for the presentation of these two subject areas. The graphic arts instructor will be responsible for the manipulative skills involved in the production of the school publication.

Using this integrated approach, journalism students will become involved in the actual mechanical processes of production, thus closing the gap between the editorial approach and the production approach. There are planned field trips to local graphic arts establishments so the students can become familiar with the processes that are essential to the production of printed materials. In this type of teaching arrangement, the class can take on the atmosphere of industry itself whereby each student has a particular job to assume, thus the students will become familiar with the values and procedures of industry, these values being production, consumption and technology. One of the objectives of this class is to create jobs within the class for each student, jobs that would reflect industry itself. Jobs are assigned to the students. These jobs would include those of: page editors, reporters, advertising managers, salesmen, circulating manager, compositors, machine operators, photographers, proofreaders, layout men, strippers, plate makers, dark room men (copy camera). The journalism students carry out the entire project from the writing of each article to the production, distribution and selling of the product.

Mr. Barber is Department Chairman of Industrial Arts in Twinsburg, Ohio.

INDUSTRIAL ARTS LEADERSHIP INSTITUTE

Joseph J. Littrell

If leadership is to be effective, someone must initiate productive action within a group.

The 1967 NDEA Industrial Arts Leadership Institute at Arizona State University was leveloped on the premise that if productive action is to occur in an industrial arts departnent, the logical person to do the initiating is the department chairman. The 24 men rought to Arizona State University last summer not only studied about leadership, but lso, using leadership techniques presented to them, they were asked to put it into pracice. One of the major areas of concern was to look to their own departments and seek vays to improve their leadership.

It is often easier to gain a new look or a new perspective when we have geographically emoved ourselves from a problem. Before leaving their schools to attend the institute, articipants were asked to identify what they considered to be special problems or deired changes in their industrial arts departments. Following short refresher study of esearch procedures, participants presented these problems or desired changes in largeind small-group discussions. Although sometimes bitterly contested, the resulting idea ind comments were further enhanced by a variety of specialists who periodically appeared before the group to inject even more concepts. Individual study was also expected, vith participants using every medium available, including an exclusive Industrial Arts nstitute reading room.

In summary, there were three major individual thrusts made by each participant it the ASU Institute. One of the major efforts was for participants to recognize, and then ise, good leadership in their departments. To encourage this, a concentrated study of idministrative and leadership practices was presented to the group.

A second activity was intended, as were the others, to involve the teachers in a deartmental safety program. Emphasis was placed on a positive attitudinal approach for complete safety study and accident prevention.

The third effort included wrestling with a variety of ideas for improvement of each lepartment. This entailed sharing ideas, critiques, and, finally, coming up with one wellrepared proposal which could be put into operation at the home schools.

Three participants of the institute have agreed to present material today about their najor proposals and tell you their experiences in setting them up and putting their ideas nto action.

Dr. Littrell is Professor of Industrial Education at Arizona State University, Tempe, Arizona.

h-11.5.6 AIAA
NDEA Institute Reports
NTEGRATING MATERIALS SCIENCE IN SECONDARY SCHOOL PROGRAMS
Chm., Howard Gerrish; Rec., Howard Weise; Speakers, Louie Melo, Marlow F. Keith, Boyd Whitt; Host, James A. Collier.

INTEGRATING MATERIAL SCIENCE IN SECONDARY SCHOOL PROGRAMS

Louie Melo

Introduction

Man's interest in fabricating materials is not new. He has used materials in one form or another for as long as he has existed.

The evolutionary changes from the Stone Age to the Bronze Age to the Iron Age and on into the industrial revolutions added many complexities to man's working environment.

It has been said, however, that none of these revolutionary changes has compared with the most recent technological revolution, "The Materials Age". This is the age in which man tailor-makes materials to work within a particular environment.

This age, then, suggests that we, the industrial educators, re-evaluate our past patterns of doing things and modify them to a point that will further help our people to understand the materials they use as a living part of the total problem-solving assignment. I is important that we become familiar with the pertinent language that will enable us to understand the terms or descriptive data that are present when industrial people discuss materials and manufacturing problems.

The industrial educator's role should include added scientific information and experimentation about the substances suggested for the problems he develops. He must strive to develop basic concepts about the internal working characteristics of substances. Students should develop an understanding of the fundamentals with reference to basic properties such as composition, physical and mechanical properties. In many ways, we must strive to develop a more meaningful bridge between the dynamics of industry and the industrial education classroom.

Learning environment

A study as presented by the Socony-Vacuum Oil Company gives us some pedagogical food for thought. It points out that average learners will retain approximately 10% of what they read. It also indicates that it is possible for the learners to retain 50% of what they see and hear and up to 90% of what they say as they do something.

As we review these few remarks more closely, we may logically agree that man would have very little to say and do if he has not read, heard and/or developed a functional understanding about the problem in question. We might also logically surmise that the "saying and doing" phase is the reinforcing mechanism that may implant the experience, thus prolonging its retention life.

Studies do suggest that every problem man faces is perceived and solved through the use of his accumulated knowledge. This is part and parcel of his total field of experience, with some on the vivid side of his learned spectrum while others reflect an almost total loss insofar as ready recall. Thus, when solving problems, man tends to use the more vivid or well-established solving tools much more often than new or weakly-learned concepts or experiences.

Studying material science

Understanding the science of materials should provide avenues to develop useful long-range learned concepts about man and the materials of his environment. Thus, if the educator is concerned with the broader spectrum of education, it appears to the writer that students should be encouraged to look for and talk about the "why" behind every "how" when involved in classroom or laboratory activity.

When reviewing complex industrial organizations, we observe that each department of the establishment exists as a contributing member toward the development of a finished product that must perform satisfactorily in a given environment. Departments are interwoven and interlaced toward a common goal. Major areas of operation often include pure research, applied research, and various levels of engineering and/or technological functions within their operational complexes. All of these, cooperatively, play a very important role in the total field of applied science and technology.

In a similar manner, the educational community should profit greatly by giving greater consideration to the total environment in which its students are learning. It should be obvious to the educator that no single department or offering of the educational environment can stand alone, just as no single part of an industrial establishment can survive or progress without the help and cooperation of other segments of the organization. Therefore, cooperative team effort, integration, collective action, coordination and so on must become a functional part of the modern educational establishment.

Thus, all of us who are members of the technological team, regardless of our particular role (students, teachers or industrial practitioners), must accept one basic premise: The numerous materials with which we work and the many operations we, or our people, discuss, teach or perform will include some communication, scientific and/or mathematical knowledge. These plus the technological blocks of information that are an integral part of the technical environment will enable all concerned people to develop stronger liberally-educated students. This is why this writer strongly suggests that communication, mathematics, science and technological educators should strive to develop

stronger interwov·· or intertwined teams toward helping young people better understand their technological world.

Material selection

When reviewing industrial operations involving product development, we note that considerable time is devoted to the selection of appropriate materials in terms of product and environment requirements. Several articles on "How Materials are Selected" by H. Clauser, R. Fabian and J. Mock, in Materials in Design Engineering, July, 1965, present a very excellent and meaningful pattern from "concept formulation to manufacturing". These presentations should be of great interest to industrial educators and should be reviewed in detail. Several selected comments are presented below. The articles express many points of "how" the "why" tasks are accomplished.

Materials selection during this modern age is, at best, a very complex operation. A fragment from the Materials in Design Engineering articles will offer additional insight:

Like most engineering efforts, materials selection is a problem-solving process. Much has been written on problem-solving, and the major steps involved have been expressed and defined in many different ways. However, there is general agreement that the major steps are:

(1) Analysis of the problem
(2) Formulation of alternate solution
(3) Evaluation of the alternate
(4) Decision

When these are applied to the materials selection process, these steps become:

(1) Analysis of the material requirements
(2) Selection of candidate materials
(3) Evaluation of candidates
(4) Selection of the candidate material that best meets the requirements.

Thus, questions with reference to why materials specialists select a certain pure or modified substance for a given application should constantly be brought to the forefront by industrial educators.

Moving from project design to project manufacturing, employing readily available materials is, in effect, poor practice. Such laboratory patterns leave little or no time for the appropriate and important series of meaningful sessions between students and teacher to bring into focus the many problem-developing considerations including materials selection as noted above by design engineering.

Industrial student of tomorrow

Time and space have not permitted us to explore all facets of problem-solving avenues opened to a typical industrial educator.

This writer did present the problems of the future and some of the numerous implications to a group of graduate students. Several key points of their deliberations are presented, in part.

The world of tomorrow needs the flexible man, the intelligently mobile man, the man who can land on his feet when his job becomes technologically obsolete. To educate for flexibility we must distinguish between training and education. To train is to emphasize fixed responses, to stress immediate goals which often have a low ceiling of possible growth. This is possibly the only way to help the person who has limited reasoning capabilities; however, his material should not be presented as a closed loop circuit. The doors toward even limited reasoning should always be kept open. To educate, however, is to foster limitless growth and life-long learning. This is the most fertile ground for tomorrow's educator when he is working with his students.

Mr. Melo is Professor of Industrial Education at San Jose State College, California.

MATERIAL SCIENCE IN JUNIOR HIGH SCHOOL PROGRAMS

Boyd R. Whitt

I should like to begin with the hypothesis that the study of materials as an integral part of our industrial arts program is becoming more necessary as our society becomes

more technologically oriented. The NDEA Institute held at San Jose State College for six weeks during the summer of 1967 was designed to provide an in-service education program of organized study in industrial materials.

The program was organized into two phases which were conducted simultaneously, one part being an organized study of materials including the properties, selection and modification of these materials. The second phase included the development of methods and procedures to integrate the materials aspect of industrial arts effectively into existing programs.

It is the second phase of the institute, that of integrating materials into a curriculum which is our topic for discussion this afternoon. In my presentation I will touch on three points: (1) reaction of fellow participants to the institute; (2) problems encountered in introducing materials as a part of the industrial arts curriculum; and (3) projections for future use of materials in industrial arts curriculum.

Our NDEA Institute was perhaps somewhat different than others in that we had no rigid requirements for papers, experiments and tests. This aspect met with mixed reactions; however, freedom in research and experimentation basically enhanced the learning situation. There was a pre-and post-test given with no evaluative concern other than to give an indication of general improvement. The results were excellent. Having participated in the institute we have all asked ourselves the question, as Mr. Melo said "What new concepts and/or problem-solving tools have been added to my expanding store of knowledge? How may these tools or concepts become an integral part of my program?" The esprit de corps and rapport of the group were high, and, with the direction of Dr Bohn, Mr. Melo and Dr. Stephenson, the majority of the participants would evaluate the institute as completely successful.

The second segment of our discussion involves the problems encountered in the integrating of materials into existing industrial arts programs. This aspect will vary for each participant depending upon the level of instruction and the previous amount of materials involved in the classwork.

Let me briefly describe our industrial art[illegible]ogram. The junior high where I am now is a new sixth-, seventh-, and eighth-grad[illegible]lding offering a general exploratory course required for boys in the seventh and ei[illegible]grade for one semester only in each grade. We attempt to introduce roughly six a[illegible]uring the two semesters. The high school is totally separate, and unfortunately ve[illegible]le interaction is involved.

Along with the normal problems of time, [illegible]ney and facilities, it seems that at this age level one of the most significant problems i[illegible]e simplification of the concepts, ideas and principles involved in materials science. J[illegible]ne Bruner in his book, The Process of Learning, has stated that "any idea can be repre[illegible]ted honestly and usefully in the though form of children of school age." It is Brun[illegible]s thesis that children can be introduced early to ideas, concepts, principles and issues, provided that these are simplified so that a particular age level of student can understand them, and that a framework is constructed so that particular facts and information may be related to something more basic. These ideas can be returned to at higher levels of complexity until a degree of understanding is reached that will be self-sustaining.

An outline was developed at the institute to aid in eliminating this problem. Basically it is as follows:

Title (including grade level)
- I. Introduction to concept, idea or principle
- II. Objectives
- III. Materials and equipment needed
- IV. Utilization in the teaching-learning environment
  - A. Teaching presentation
  - B. Observations and conclusions
    - 1. Questions to be answered
    - 2. Areas for further study
- V. Definitions of new terms
- VI. References

Most participants developed several of these presentations in various areas and for various grade levels. These have proven to be of significant value in attempting to integrate materials into the junior high industrial arts curriculum.

As our general exploratory industrial arts program for the seventh and eighth grade grows and is re-evaluated, there are several areas where I can see a need and opportunit

or growth involving industrial materials. Projecting now, I would like to see growth in our program around the following:

(1) Developing in the students a greater awareness of materials as a part of our affluent society.
(2) Developing in the students an understanding of the various materials he may encounter as he moves into his own working environment.
(3) Exposure of industrial arts to both boys and girls.
(4) Encourage students to experiment and solve problems which arise from their working with materials in the lab.
(5) Information presented concerning materials should be directly related to a student's activities in order to help develop a framework which will aid in the understanding of concepts, ideas and principles.

Mr. Whitt teaches Industrial Arts at Harvard Junior High School, Harvard, Illinois.

Th-11.5.7 AIAA
NDEA Institute Reports
AUTOMATION AND NUMERICAL CONTROL
Chm., John O. Conaway; Rec., Edward Paloney; Speakers, Louis J. Pardini, James W. Entwistle, Thomas Lawson, Dale Bringman; Hosts, DuWayne A. Gilsrud, Lloyd Paler, Richard Aseltine.

AUTOMATION AND NUMERICAL CONTROL

Louis J. Pardini

If I were to tell you that the earth stood still, you would think that I belonged in the days of Galileo. Certainly the earth does not stand still, and neither does technology. In fewer than sixty short years, we have moved from Kitty Hawk to hypersonic speeds. The wings of current aircraft are longer than the length of the first powered flight. You can rest assured that this same type of progress takes place in the world of metal shaping, metal cutting and metal joining. You are probably aware that I am referring to the automation of machine tools resulting from a process known as numerical control.

What is numerical control? Simply defined, it is a rapid and efficient method of transferring a blueprint into a finished product. The manufacturing information on the drawing is transferred to a one-inch wide, punched tape. With numerical control, the actions ordinarily performed by the machine operator are controlled automatically by synchronous motors which are attached to the lead screws as the punched tape is fed through a reader. The proper circuits are actuated, which tell the motor when to start, how fast to turn and where to stop. The same operations which are employed in conventional machining are also employed with numerical control, but now different skill requirements appear, especially for the planner, the machine operator and the maintenance man.

The reality of numerically controlled machine tools began to take shape when the US Air Force realized the need for improved methods of machining wing sections out of solid blocks of metal. The Massachusetts Institute of Technology was selected to develop a control unit to operate a vertical milling machine. By the fall of 1952, the staff at MIT had developed the first numerically controlled milling machine. This development reinforced the concept that numerical control was practical as an industrial tool. The original control unit was developed at a cost of one million dollars. This unit was expensive and impractical. It utilized vacuum tubes which constantly had to be replaced, and occupied 2500 square feet of floor space. As electronic technology has developed, the cost has decreased steadily, so that it is now possible for small job shops, as well as school shops, to have numerically controlled machine tools.

Before numerical control was accepted by industry and the labor force, prejudice and ignorance had to be overcome. In several plants, numerically controlled machine tools were sabotaged by employees; not the destructive type of sabotage, but tampered with to

keep them out of operation. The employees were afraid that they would be replaced by machines. They ignored the fact that these machines could not think for themselves. They had to be told what to do and this took human beings; they needed maintenance and repair and this took human beings. Industry still needs trained people in these areas.

Once the fear which comes from a lack of knowledge is eliminated, numerical control is readily accepted. To remain competitive, the manufacturer must keep up to date with new methods and modern equipment. The question is not, "Do they need numerical control?" but rather, "How can they afford not to have numerical control?" Relatively low-cost numerical control equipment makes it possible for the small job shop to be competitive.

How does industry justify numerical control?

Once a job is put on tape, the tape can be stored for repetitive orders.

It reduces storage space requirements.

It reduces inventory of raw materials, in-process materials and finished products.

It reduces delivery time.

It enhances quality control.

It reduces the expense for costly jigs and fixtures.

It reduces cost of the finished product, thereby creating greater demand, which, in turn, creates more jobs.

Progress of the human race is directly related to the advance of technology. We have progressed from crude hand tools to power tools to mass production, and now, numerically controlled factories are on the horizon. This technology affects not only our material life, but our cultural life as well.

How does all of this affect industrial education? There is a definite problem of providing a closer relationship between the technical developments of industry and the program of industrial education. During the past few years, new technical developments such as the computer, numerical control systems and automation, have become major factors for increasing the design and production capabilities of modern industry. These new concepts in modern industrial technology are not generally incorporated into the industrial arts curriculum.

We must work to close this technological-educational gap so that millions of young people can gain the education, skills and knowledge needed to live in the 1980's. The curriculum must be up-dated to meet the needs of an expanding and even more complex society.

The opportunity to study concepts of, and work with, numerical control will certainly produce an immeasurable increase in student understanding of our industrial society. Numerically controlled machine tool equipment is needed to fulfill a general objective of providing a broad orientation to the concepts of numerical control systems of industry as they relate to the industrial education curriculum.

If we accept the concept that numerical control is a new and essential part of modern industry, then it follows that we must incorporate the concepts of numerical control into the industrial arts curriculum.

You may argue that this is expensive equipment, out of reach for the average budget. Let us examine the cost of a numerical control unit. Existing milling machines in the school shop can be retrofitted for approximately $6,500. The cost to the school district can be reduced if we can make this unit service several schools. Since most metal shops have vertical milling machines, the machine control unit can be shipped from one school to another. Special retrofit adaptors can be purchased for a nominal sum to fit different milling machine models. The shipping crate can be remodeled to serve as a permanent crate for transporting the machine control unit to the various schools. With proper scheduling, one machine control unit could service six schools, as is currently being done in the school system in Albuquerque, New Mexico.

In the days when numerical control was first conceived, the average person tended to avoid the subject of computers and of numerical control. We tend to avoid the things we do not understand. We feel secure in our comfortable ruts and, therefore, resist change. Unless we shake off this lethargy and accept the challenge of numerical control in our industrial education classrooms, we will be compared to a Roman chariot on the freeways – adequate for its time, but inadequate in today's technology.

Dr. Pardini is Assistant Professor at Arizona State University, Tempe, Arizona.

REPORT ON A UNIT IN AUTOMATION

Dale D. Bringman

At the conclusion of the institute held at Indiana State University last summer, participants and instructors agreed that the material studied was mandatory for updating industrial arts programs. To test the feasibility of teaching high school students material of this nature, I offered a nine-week session in automation during the first semester of the current school year. Previous student exposure or background in this area was nil. The class was small by most standards, consisting of fifteen boys in grades nine through twelve. The task of presenting a unit of this type was also made easier because of the school's proximity to Indiana State University, which made equipment as well as hands-on time available. The school day for these students consisted of five seventy-minute periods with no study halls, as each class met four times weekly. Thus, the unit covered thirty-six class meetings.

The ability of the students was as varied as the grade level. Using IQ scores as a rough indicator of general ability, a range of 50 was found with limits at 75 and 125. The mean and median IQ scores for the group were 97 and 96, respectively.

The plan of procedure was simple and allowed for adjustments in time and change of material as determined by student response. However, in general, the main objectives were to provide time and equipment for (1) experience in programming and operating a piece of tape-controlled equipment, a vertical milling machine and (2) writing and testing programs to control a digital plotter.

Using a traditional approach for material presentation, instruction on numerical control concepts required approximately ten of the thirty-six class meetings taken by the unit. Background was given on the state of the technology, its importance and the advantages and disadvantages of numerical control as a production tool. This was followed by live demonstrations of tape preparation equipment and the tape-controlled mill. The integration of the designer, draftsman and programmer was emphasized as the students chose, drew and programmed machine tool paths. Several small programs were written and checked by the instructor. After two to three class meetings of programming practice and testing, programs were written, and tapes were prepared and tested by cutting these tool paths into small masonite blocks. The remainder of the ten class meetings was spent in expanding the proficiency of the students as programmers and operators of the equipment. During this five- to six-day period each student was able successfully to program, test, de-bug and re-run from three to six accurate programs.

Formal evaluation of this portion of the unit was postponed until the end to attempt to test true retention of programming concepts.

The remainder of the time devoted to the unit was spent by the students in becoming knowledgeable of computers, how to communicate with them, and, more explicitly, how to program a computer to cause a digital plotter to serve as a drafting instrument in the production of simple drawings. Again, a traditional approach was used in the presentation of this material. Examples of products and uses of drafting machines were studied as an introduction. Also, some time was spent in giving some basic drawing concepts to a few students who had not been exposed to drawing or drafting before the unit began. A demonstration followed which gave many of the students their first view of a computer and its capabilities. It was shown both as a handler of arithmetical problems and as a handler of data and intermediary serving to allow man to direct a pen over paper.

The technical information was of such a nature that presentation in easily digested blocks was possible. Once the student was able to think of two-dimensional space in terms of Cartesian coordinates, then only one simple computer statement allowed the beginner to draw straight lines, one at a time, to accomplish simple drawings. As soon as this step was understood, more of the language was presented for mastery until enough power was given to the students to allow them to draw nearly any commonly used drawing.

Laboratory time was utilized in writing programs for the production of from four to eight simple drawings. As well as writing programs, students were able to punch cards which helped in the realization that industrial uses of these drafting procedures force effective communication – a weakness of many industrial arts students.

On this, my first effort with a unit of this type, a major aim was to determine if high school students with a wide range of abilities would be able to master sufficient skill to communicate with the equipment being studied. For this reason the instrument used for

evaluation measured retention of programming skill only. The instrument consisted of three sections. Section I asked students to write a machine tool program from a part sketch. Section II required each student to trace a tool path on grid paper as interpreted from a program print-out. Section III was the most difficult and time consuming, as this section required writing a computer-plotter program using a sketch as a problem. In analyzing test scores, raw scores were changed to scores with a possible high of 100 and a low of 0. Section I scores ranged from 0 to 100, had a median of 10 and a mean of 83.6. Section II scores ranged from 0 to 100, and had a median of 69 and a mean of 70.3 In Section III, scores ranged from 0 to 100, had a median of 50 and a mean of 57.6. The scores on Section III indicate far less learning and skill than was exhibited in pre-test sessions, for all three sections of the test were given to the students for completion in one seventy-minute period, and only six of the fifteen finished.

In conclusion, it should be reported that the objectives of the unit were accomplished and that the students learned the material, and seldom has such enthusiasm been shown for learning by high school students.

Mr. Bringman is Industrial Arts Instructor at Indiana State University, Terre Haute, Indiana.

Th-11.5.8 AIAA
NDEA Institute Reports
COMPUTER GRAPHICS AND NUMERICAL CONTROL
Chm., Joe E. Talkington; Rec., Edward T. Anderson; Speakers, Stanley R. Amyx, Ronald Foy, A. Milton Garrett; Host, Dennis D. Koelling.

COMPUTER APPLICATIONS IN THE SCHOOL CURRICULUM

Ronald Foy

The fantasies of the "never, never land" of computers are not only upon us but will also pass us by very shortly if we are not quick to catch hold and hold on.

What does the advent of the computer have to do with the teaching of industrial arts of drafting, woods and metals in particular? If the computer does have important applications, how can a class be taught without one? Can the computer, in fact, draw a working drawing? What are some of the advantages of having a computer draw a problem? These are questions this report will attempt to answer.

The arrival of the computer in the industrial world should have a strong impact on the teaching of industrial arts. Most of us now realize that we cannot teach the modern practices and processes of a machine shop if we use the treddle or bow-driven lathe of old. Neither will we be able to teach the modern practices and processes of industry if we do not include the computer. Machines in both the woodworking and metalworking fields are now numerically controlled. The testing and analyzing of engines are now done with computers. Computers are in themselves electronic equipment. Computers are even taking over the drafting chores. This will be the main area of this report.

The computer has a language all its own. It is not a complicated language and not too different from the drafting language we have been using for years. The computer has to be "told" every move by this language. This will force the designer or draftsman to think out each step carefully and in orderly fashion.

The planning or programming of a drawing is the area that can be taught to our draftsmen of tomorrow. We have taught drafting through visualizing the object in the many views wherein it can be represented. The computer has to start from a reference point, and every order thereafter has to refer to another point or line that the computer has previously located. If the student is cognizant of the fact that every line, part, shape and form need to be referenced from a particular point or base line, the transfer into computer language will be easier. The student should become acquainted with the basic

steps in programming a computer.

The teacher does not need to have a computer at hand in order to teach a unit in computer graphics nor to have the students aware of the graphic language of the computers. Film, overlays and outside reading can introduce the student to the proficiency and attainments of this time-saving machine. Class demonstrations can then show the process in which the machine computes each move in relation to other information it has stored. Actual problems can be programmed to influence the student's planning in thinking in the computer's graphic language. A few exercises such as these will help gear the student's thoughts in dimensioning and will help him in programming when he gets into industry.

The fact is that the computer can and is doing a good share of the drawing today and is influencing drawings that are still man-made. With more and more machines going to the numerical control system, the designer and engineer have to plan and present the part or parts with the programmed machine in mind. Numerical control machines operate on commands similar to the commands of the computer graphic language. This again authenticates the urgency of being conscious of this new approach.

Some problems drawn on plotters teamed with computers possibly will take as long if not longer to program as a draftsman takes to draw the problem originally. However, the computer is capable of doing the job much more accurately. Descriptive geometry problems can be programmed so that the computations and plotting are made to the closest ten-thousandth of an inch, somewhat closer tolerance than most draftsmen are capable of drawing. The drawing a computer makes can be stored for later use, which is one of its major advantages. The program can be stored on tape and run through a plotter any time another drawing is needed.

The light pencil method of drawing is a giant step ahead of the plotter method, especially from the standpoint of speed and storage capacity. This method has many more advantages too numerous and technical to mention here.

To summarize, if the drafting students of today are to acquire an accurate picture and introduction of the drafting assignments of tomorrow, they should be introduced to the immense role that the computer and numerical control will play in their lives.

Mr. Foy is Industrial Arts Coordinator at Snyder Public School, Snyder, Texas.

Th-11.5.9 AIAA
NDEA Institute Reports
NEW SOURCES FOR CONTENT IN INDUSTRIAL ARTS
Chm., Clint A. Bertrand; Rec., Rossmond S. Cooney; Speakers, Harlan J. Clouse, Richard L. Fricke; Host. Henry Loats.

OCEANOGRAPHY

Harlan Clouse

It is important to note that the study of the ocean involves many fields. The ocean and its resources have affected geography, history and economics. For the future development of these resources, geology, chemistry, biology and physics all have roles to play.

I believe that every age is exciting to the people who live in it, and doubtless this colors our own appraisal of the second half of the twentieth century. Even so, it is difficult, if not impossible, to think of any past time in which the horizons of man's world and his understanding of it have widened and deepened so rapidly.

In this half of our century, we find the earth's crust being probed more deeply than ever before; the vast unknown seven-tenths of the planet that lie under the seas and oceans is beginning to be explored. The upper atmosphere and closer interplanetary spaces have become, for the first time, accessible to man and his instruments.

What do we know about this underwater realm that covers seven-tenths of the earth's surface? How did it originate? What can it reveal to us about the beginning of life? How can we utilize its resources to feed the growing population of the earth? How can we mine

the enormous deposits of minerals it contains? What is currently being done to learn more about this vast domain?

Ancient man regarded the kingdom under the sea as a dark and terrifying realm. It was not until the pioneering oceanographic voyage in 1872 that man's superstitions about this world began to be replaced by scientific knowledge. Even today, the greater part of the undersea world still remains shrouded in mystery.

The sea's history is written by the composition of the sediments and the order in which they lie are a lasting record of the various periods of the earth's history, showing such events as the advance and retreat of the glaciers, the activity of volcanoes and the periodic changes of climate. When the whole record is known, it may be that some of our theories of the continents and seas that surround them will have to be revised. Within its hidden depths the sea holds not only material wealth, food and minerals, but also the keys to the understanding of much of the mystery and meaning of our earth and perhaps of other worlds as well.

The study of the oceans is a task that will never finish. It is a study that will be rewarding in our continued effort, for the resources of the sea are infinitely rich, and the ocean's effect on our lives is far-reaching. In virtually every field – communications, transportation, power generation and distribution, manufacturing, agriculture, food processing and medical science – progress is being made more rapidly than at any time, and in every one of these adventures the ocean plays a significant part.

From the ocean we will find answers to pressures and corrosions and problems totally alien to land life. This may make possible submarine farms, submarine factories, submarine vehicles, possible submarine dwellings. This will make the earth three times larger to match its exploding population.

We must learn economical means of salvaging much of man's works that have been lost in the sea during man's long history of sea-going operations.

A new generation of pioneers will emerge from the conquest of this last geographic frontier on earth. The world's oceans will be the future land of opportunity for the energetic. This can only come from knowledge of the ocean environment, progressive technology and man's pioneering instinct.

Critical demand for more food to feed the world's expanding population may find a solution in new sources and increased supplies of protein products from the sea. Vast amounts of mineral deposits are in and under the sea: oil from the Gulf of Mexico, gold from the waters off Alaska, minerals from the Red Sea, diamonds from African waters. Engineers and scientists are developing new and cheaper methods of extracting them.

The sea dominates our world. It regulates the weather. It is the only source of all our water. It provides a home for plants and animals greater in volume than that of our land.

The ocean may some day provide a basic source of fresh water. As cheaper methods are devised for desalination of seawater, arid lands may support many people. Salt water conversion is relatively expensive at present. But it represents an important step in man's unending quest for greater control over his environment.

Alcoa recently announced a breakthrough development in water desalination methods which may find world-wide application because of greatly lowered cost. This new system makes possible, for the first time, the utilization of widely-available waste industrial heat to convert salty, brackish or alkali waters into water of ultra-purity.

The ocean's enormous energy can and will be harnessed, as in tidal power plants for generating electricity. These energies can also influence weather conditions and affect the conditions of life for sea creatures. While any present-day schemes of changing climates are far-fetched, experts foresee the day when proposals along this line will be advanced. At least this indicates areas in which some research will have to be done.

At present man now uses the ocean as a final receiver for his sewage and industrial wastes and as a dumping ground for radioactive materials. This hazardous situation will need to be controlled through appropriate programs in the future. Even today reasonable conservation programs are needed if our supply of fish and seafood is to be protected from short-sighted exploiters.

We must also be concerned with the role our nation plays in the exploration of our oceans. To be world leaders, we must lead the world, and this includes the seven-tenths of the world that is covered by water. Our national security depends on the strength we derive from knowledge and technology of our ocean world. The future of the world will depend upon the development and exploration of the ocean's food and mineral resources. Here our exploration leadership will provide resources that can help reduce famine and

poverty among the peoples of the world. Our world's oceans are as important as our outer space explorations, for it is here that man will live and find the material of which life is made.

We must expand considerably our material and human resources and consider what is necessary to promote this new frontier in order to attract competent and qualified personnel for the task that lies ahead. At present the United States is far behind in her development of oceanography. One method of improving our national standing would be to interest more young people in this field.

The ocean is extre nely important to every person of our world, whether he lives along a coast, in the hills or on the plains, for life on this planet evolved from the ocean, and now the pressures of civilization will force man back to the ocean for survival. The greatest opportunity will be for the generations of today who are looking for a new industrial frontier.

Mr. Clouse is Industrial Education Instructor in Pueblo, Colorado.

NUCLEAR SCIENCE: A NEW TOOL FOR INDUSTRY

Richard Lee Fricke

The content for industrial arts has traditionally been taken from numerous areas. Its very nature has emphasized breadth. Science, technology and industry are developing a wealth of new content that can give added breadth to industrial arts.

Science wil' [illegible] new concepts to the academic upper one-third. Industrial arts has an [illegible] ity to teach these new concepts, in a less sophisticated approach, as [illegible] existing courses.

A sug [illegible] investigate the field of nucle[illegible] science and include some of its basi[illegible] nd applications in the future industrial arts course of study. The following points are called to your attention:

(I) <u>Identification of the field of nuclear science.</u> Science has isolated more than one hundred basic elements; ninety-two are naturally occurring and the others have been developed by acceleration. An element is composed of a collection of atoms; and nuclear science is the study of the atom and its cousin the isotope. The atom is made of electrons, protons and neutrons and has mass. The basic atom is stable, but by changing its mass, it becomes unstable (uneasy or restless) and is called an isotope.

An isotope emits radiation or gets rid of energy. This is called radioactive decay. The decay rate of isotopes can be measured, and each isotope has a well-defined rate of decay. Radioactive decay of an isotope is determined by how long it can emit radiation and is defined as its half-life. One half-life is the time lapse necessary for the isotope to lose one-half of its total radiation energy. The half-life time ranges from a few seconds to thousands of years.

Three common types of radiation decay occur. They are: (1) alpha rays, (2) beta rays and (3) gamma rays. These rays have different personalities and each one can be utilized to perform useful tasks.

The alpha ray is a high-speed ray traveling only a short distance with very weak penetrating power. Skin or paper will shield the alpha ray. The main safety concern is to keep the alpha ray from entering the internal part of the body.

The beta ray has better penetrating qualities than the alpha ray. However a one-inch piece of wood will shield it. The main safety concern is that it causes surface skin burns.

The gamma ray possesses the strongest penetrating power, requiring thick walls of lead, water and concrete to shield it.

(II) <u>Applications of nuclear science in modern industry and industry of the future.</u> Nuclear energy is usually associated with thought and fears of destructive weapons of war. However, nuclear energy, in the form of a "clean weapon", can be used to dig canals, loosen strata to find natural gas, build deep harbors, and develop power for ships and electric

generating plants.

Radioisotopes are being used in industry to test welds, perform thickness gauging, perform tank level monitoring, aid in friction wear studies, perform leak location pressure testing, perform detection of interface, tracing, flow gauging, luminescence and activation analysis of materials.

Agriculture uses the isotope to study plant physiology and animal husbandry. The medical profession uses isotopes to detect normal and restricted blood circulation, treat cancer and perform many other applications.

(III) Implications of nuclear science for industrial arts. Junior high school science classes are introducing their students to nuclear science, including topics on the atom, types of radiation and radiation safety and sickness. The junior high school industrial arts program could correlate its program to follow the science presentation and include some basic applications of nuclear science and radioisotopes to industry. The junior high science and correlated industrial arts classes would be introducing this content to almost every boy in the school. The senior high school industrial arts curriculum could continue with more technical nuclear science content and its application in technology and industry.

It is suggested that this content be taught as related information to the units of the industrial arts laboratory. In no way is it suggested that the project be phased out of industrial arts but that it be used to help the student relate to materials, principles and new industrial tools that surround him.

The industrial arts teacher will have to prepare himself to teach this new content. The Atomic Energy Commission has many booklets available on nuclear science. (A selected list of booklet titles is included here. They are available free of charge when requested on school letterhead.)

Nuclear science is a present-day tool of industry; if the people responsible for industrial arts do not teach this new content to the masses, some other department of the school will teach it. The challenge is for industrial arts to rewrite its course of study to include this new content.

NUCLEAR SCIENCE REFERENCE MATERIAL

Careers in Atomic Energy
Direct Conversion of Energy
Food Preservation by Irradiation
Radioisotopes in Industry
Radioactive Wastes
Nuclear Terms – A Brief Glossary
Power from Radioisotopes
Power Reactors in Small Packages
Popular Books on Nuclear Science
Our Atomic World
Atomic Fuel
Atomic Power Safety

Request from:

US Atomic Energy Commission
P.O. Box 62
Oak Ridge, Tenn. 37830

Mr. Fricke is a teacher in Ottawa, Illinois.

Th-11.5.10 AIAA
NDEA Institute Reports
CURRICULUM FROM CONTEMPORARY INDUSTRY
Co-chm., F. Victor Sullivan, Gerald Steele; Recorders, Duane Bingham, Bob L. Agnew, Ben A. Tarr, Donald L. Hrabik, Max Lundquist; Host, William Studvin.

A UNIT IN MANUFACTURING IN NINTH GRADE METALWORK

Donald L. Hrabik

There is now a need to improve industrial arts. One way to help fulfill this need is by teaching a unit on mass production which has been tried and proven by many teachers.

It should be included in every industrial arts program in areas where application becomes feasible.

Great demands are being placed on us to create new programs that more clearly reflect the educational needs for the present and future. Because of the technology explosion, it is almost a must that we inject a better method of teaching industry. Thanks to an NDEA Institute, I had the privilege of participating in and learning about mass production.

During the past year, a manufacturing unit was introduced in the regular 9th-grade metalworking class at Old Mission Junior High School. The class ranged in composition from high ability to low ability students, with the major portion of the class average. When the topic was first suggested in class, there was very little response. There was a small response because the students didn't want to take the time away from their project work. Possibly many of the students had no idea or understanding of the manufacturing concept. After some discussion they decided it might be a good idea to try this approach in learning about industry.

The product was a teacher-directed choice to give the program a better chance to succeed. With a little guidance the students selected a two-piece fishing pole holder made from a combination of two metals. Offering a student-appeal product is another important facet of success. The manufacturing unit lasted three weeks.

During the manufacturing unit, a corporate structure was set up with a board of directors elected by the class. The board of directors then selected the president, who chose a plant superintendent, who in turn chose the foremen. A corporate structure filled in this manner worked quite well with the mixed-ability class.

Research and development, job analysis, production flow, plant layout and material analysis were discussed in detail. The class was broken down into groups to design and build templates, jigs and fixtures for certain aspects of the production. Other activities covered were record keeping and advertising. The product was produced in line production and was completely packaged with directions for use included.

Student reactions and enthusiasm to the production unit were much more favorable after the unit was over than when it was first mentioned. Students not familiar with success found success in doing one job operation. Troublemakers worked well because they were disciplined by the demand of the job and their fellow workers. Individual differences ranging from high to low ability were easily dealt with by placing good students in strategic places on the production line and in the administrative jobs.

Local administrators and other area disciplines were invited to observe the line in production along with a briefing on what was studied up to that point. They felt it was a tremendous asset to the industrial arts program. Interest was also express[illegible] with other area disciplines. The success of updating industrial arts pro[illegible]s dependent upon administrative cooperation and progressive teachers.

In conclusion I would like to emphasize the importance of a unit in manufacturing to interpret industry. New approaches to industrial arts are being tested at this very minute by well-known educators, but we can help ourselves in time of need and the need is now.

Mr. Hrabik is Industrial Arts Teacher in Overland Park, Kansas.

Th-11.8 AIAA
AIAA Dinner
TEACHER RECRUITMENT AND COLLEGE AND HIGH SCHOOL CLUBS
Chm., Rex Miller, W. A. Mayfield, William Kemp; Speaker, Dr. Bernard Kaye; Host, John G. Lind.

PROBLEMS IN RECRUITMENT

Bernard B. Kaye

In the past seven years, I have had the opportunity in varying degrees to have direct contact with, and the responsibility for, three personnel departments in three school systems.

This experience has convinced me that no two personnel departments can or should

function the same way. Each school system is different. Obviously there are differences in size. Teacher group affiliations are different. The role various administrators play is different, the role the Board of Education will play is different. State laws differ. Systems differ in their stages of development. Systems differ in their closeness to and affiliations with universities. There are differences in the major occupations of the wage earners in the cities. Cities vary in racial composition and attitudes. School systems vary in their ability and willingness to support public education in general, and specific parts of the educational program. The attitudes of teachers and the citizenry of the communities vary.

These are but a few of the differences in school systems, and considerable time could be spent on each of these, but for our purposes it would seem sufficient to recognize that these major differences do exist, and that these differences can affect the problems which must be dealt with in administering the personnel department of the school system.

In spite of these differences, I believe that there are some elements and trends which are common to an effective personnel program in all school systems. These trends or elements I'm about to describe may be handled in different ways in different school systems.

The most important responsibility of the school personnel program is the recruiting and retention of the most able personnel available. This would include the professional staff, the non-professional staff, and the relatively new category, supporting the professional staff, called teacher aides. The trend in most school systems is to expand recruiting programs. We are living in a teachers' market and we will undoubtedly continue to have a teacher shortage for quite some time. This is especially true in the case of industrial arts teachers. We here in Minneapolis have added staff to the personnel department and have been able to expand our recruiting.

The recruiting program should be well organized. It should be designed so that the school system will have a basically well-balanced staff in terms of age, sex, location of training, experience and special interests. Many decisions will need to be made; how much should be budgeted for this purpose; how many teacher training institutions should be visited; how many states should be covered; how far recruiters should travel; how long they should be out on the road. Should the same individuals recruit in the same schools each year? Which new schools should be visited? Who should be doing the recruiting? Should more than one person visit a teacher training institution at any time? How many visits should be made to some schools where recruiting has been successful in the course of an academic year? Should recruiters go out during the summer?

A new trend in the field of personnel administration is that of making a concentrated effort to recruit the qualified teachers from minority groups. We have made a real effort in this direction. We have visited many schools in the South where non-white teachers are trained. We have had minority group teachers recruiting for us. We have actively sought the help of local agencies in recommending qualified minority group candidates to us. We will participate in a special recruiting program where an agency is attempting to bring recruiters together with minority group candidates from the South who are interested in moving to other areas. We are also in the process of exploring other arrangements that will help us identify qualified non-white candidates.

Another trend in the area of recruiting is that of granting more authority to the recruiters in the field. It is recognized that all appointments must be approved by the school board. This is accepted procedure. It is my opinion, however, that professional recruiters for the school system should be given the authority to employ pending only the approval of the school board. This authority can be delegated by the superintendent of schools.

While out in the field, recruiters should offer contracts only to those individuals whom they feel are superior candidates. The recruiter will need to set a higher standard for employing away from home in view of the fact that he will not have the benefit of the thinking of others from his home system. In addition, the candidates recruited in the field may be employed on an unassigned basis and should have the ability, and be willing, to fit into any one of a number of vacancies that will occur.

This trend of offering contracts in the field is not as hazardous as one might think. Recruiters usually have the candidate's grades, references, including evaluations of student teaching, recommendations of placement officials, and the personal interview upon which to base a decision. The candidate may be offered a contract for a specific position or, as previously mentioned, on an unassigned basis. The recruiter should not expect the candidate to sign a contract immediately. Most school systems now require the candidate

to sign and return the contract within ten days in order to be valid. This prevents the possibility of the candidate's collecting a number of contracts and holding them for extended periods of time prior to making a decision.

There are several new sources for making the needs of the school system known to potential candidates. The Association for School, College and University Staffing now publishes the ASCUS annual. Individual school systems may purchase ads in the annual which is distributed to candidates. Similar services are provided by other organizations. Purchasing this type of ad seems to have some merit.

There has been some experimentation with automated recruiting. The NEA and the ASCUS organization have done some work in this area. Information about the candidate is fed into the computer. Contained in the file will be such things as the candidate's area of specialization, sex, age, special interests, location preferred, type of school sought and other pertinent information. School systems will list the vacancies they have, including the fringe benefits they offer, specifics about the educational program, and other information which might be of interest to the candidate. The computer then attempts to match the two and provide the candidate with the names of the school systems which meet the preferences of the teacher and provides the school system with the names of candidates who fit the qualifications they have set forth.

Recruiters are now realizing how important it is to have personal contact with the placement officials. In this day of the teacher market, educational salesmanship is needed both with candidates and with placement officials. Placement officials have considerable influence over candidates. A favorable impression on placement officials, by the recruiter, as he represents his school system, can do much to get candidates to give the school system favorable consideration.

In spite of this emphasis on recruiting in the field, we recognize that most candidates will be screened at home. However, recruiting is necessary in order to insure a continuous supply of well-qualified candidates with diversified backgrounds, training and experience.

Whenever possible, multiple interviews should be used when screening candidates at home. It is helpful to involve subject, area or grade level specialists. Principals should also be involved in the screening process. Some school systems utilize testing programs. Others require writing samples, in addition to the usual credentials. Many smaller systems actually visit experienced teachers who are applying for positions and observe their teaching. Whenever possible, the candidate should have the opportunity to talk with the principal of the school where the vacancy exists. Whenever possible, the candidate should also be given an opportunity to see the school and actually see the classroom in which he might be teaching.

The mechanics of applying, obtaining references and materials for, and screening of candidates should be simplified and made as efficient as possible. Many school systems lose excellent candidates who are most anxious to teach because employment procedures are unnecessarily prolonged. The candidates feel compelled to accept other offers.

Within the very recent past, we have streamlined our own hiring procedures. We have eliminated two busy desks from the processing of applications after the offer of employment has been made. This has cut from 5 to 15 days off the processing time. In the height of the hiring season, 5 to 15 days is crucial. It was our feeling, as we reviewed this process, that we were losing fine candidates because they just hadn't heard definitely and decided that they couldn't wait any longer.

In situations where it is necessary to employ teachers on an unassigned basis, the assignment should be made as soon as possible. The important consideration in all of this is to match the needs of the position with the qualifications for candidates. The particular qualities sought by the principal must be considered. The preferences of the new employee are considerations which cannot be overlooked.

Careful record-keeping is an important aspect of an effective school personnel program. As mentioned earlier, the procedure for obtaining information must be organized efficiently. It is equally important to maintain these files and keep them up to date. The records should be kept so that they are readily available to authorized personnel. Few experiences are as frustrating, embarrassing and time-consuming as searching for a missing folder. The selection of competent and responsible clerical employees can do much to avoid this type of experience. Careful record-keeping is important in recording the various personnel transactions which take place. Vacancies, and the reasons for them, should be recorded. Position descriptions should be available. Transfers need to be recorded carefully. Outgoing leave of absence needs to be part of the record. Once

positions start being filled, these need to be recorded properly. As you can see, what we are talking about here is an efficient bookkeeping system. The bookkeeping system should be designed to accommodate the needs of the system. Personnel men recognize that good record-keeping can help build confidence in a personnel department.

To give you some idea of the scope of the task, I'd like to share these figures with you. The average teacher turnover for the beginning of a school year in most systems ranges between 10 and 17%. We in Minneapolis are fortunate to have relatively good holding power, with our turnover being just under 10%. In a fairly large school system, it would not be unusual if the turnover during the course of a year was about one teacher every other day.

In the normal course of events, a school system will receive between 7 and 20 applications for each vacancy it fills. Simple arithmetic will give you the approximate volume of activity in the personnel department. These figures may vary somewhat with individual situations, but they are generally the pattern.

A sound promotion policy is something in which most candidates are interested. Administrative, supervisory or promotional positions should be advertised so that all qualified staff members have an opportunity to apply and be considered. This notice should give a fairly comprehensive description of the position. Although some school systems have the policy of promoting exclusively within the school system, I would advocate considering all qualified cand[illegible]es. However, if there were two candidates of equal ability applying for a position, the [illegible] candidate should be given the nod.

Qualified candidates for admi[illegible]rative positions should be screened rather than be selected on a more arbitrary basis. The opportunity to appear before a screening committee is good for staff morale. The screening committee should rank the candidates in order of strength. In some situations, candidates are graded in general classifications like excellent, good, fair and poor. The personnel department will usually have direct involvement and a leadership role in the scree[illegible]ing process. The screening process can also serve as a training program for the candidates involved. From my experience, considerable learning takes place during this process on the part of both the candidate and the screening committee.

Many school systems now feel the need to participate in the training of their administrators and supervisors. Some have developed training programs which permit eligible candidates to be released from their responsibilities to spend time with experienced administrators. Others conduct a series of workshops for selected candidates. Som[illegible] use [illegible] combination of these two approaches. Basically, the selecti[illegible] appointments should follow established procedures which give all interested and qualified candidates an opportunity to be considered. However, there will be situations where the superintendent and/or those to whom he delegates this responsibility may feel the need to fill a position varying from the established procedure. What is best for the total school system should be the overriding factor.

With your permission, I would like to share with you some thoughts I have on the teaching of industrial arts in the public schools of America today. I do not claim to be an expert in the area of industrial arts but make these suggestions as a person who has had close contact with boys and girls of all ages, and as a person who is vitally interested in the educational programs offered by the public schools of this country and the effect they have on our society.

I should first like to focus my attention on the programs offered to boys who come from disadvantaged homes - boys who attend so-called inner city schools. I believe there is much that can be done in the public schools through our industrial arts programs to upgrade living conditions in poverty areas. What's wrong with teaching a boy how to repair a hole in plaster if one exists in the middle of his living room? Why don't we teach these boys how to fix doors where the hinges are pulling away from the door frames? Why don't we teach these boys how to paint? Why don't we teach the boys to repair concrete steps that have gaping holes or have wide cracks or are just plain falling apart? Why can't these boys be taught how to repair leaky faucets or free clogged drains? Why can't these boys be taught some of the basic elements of home repair?

Junt think what this can do for a boy's ego, if he can make a definite contribution to repairing and upgrading the appearance of his home. His parents will look at him in a different light. He will view himself in a new image. An obvious result is that the appearance of the home will be improved tremendously.

Another feature of this type of program is that the youngster will feel he is learning something in school that relates to his everyday life.

I believe what we are talking about here is Nehru's principle – when people are hungry, teach them how to grow food – when they are without clothes, teach them to make clothes. What I am suggesting is that when a home is in a state of disrepair, the boy living in this home should be motivated and taught how to make necessary repairs. I am not implying that the craftsman is to be replaced, but with the labor market what it is today, I believe it is essential to teach boys who come from homes where there is no money to employ a journeyman how to make the repairs to which I have referred.

This can also be a source of income to boys in the inner city. Once neighbors realize that a boy has the talent, he will soon be asked to make repairs for them. The charge can be minimal, yet it can provide a source of income to the youngster. This will build a sense of pride and self-confidence.

This proposal can be expanded, I believe, to all boys attending school. This past week-end I was involved in a project of cutting down doors after the laying of carpeting in our new home. My fourteen-year-old boy and I spent about four hours cutting down fifteen doors. We used a power saw, which I purchased for about eighteen dollars about six years ago. I can't recall ever being taught how to use a power saw in my school experience, nor is it taught today. I believe that a major portion of our program of industrial arts should be related to the handy-man aspect of home economics. A key element in this program should be making suggestions with regard to basic tools which are needed in every home. I recognize that the interest ability, manual dexterity and motivation of individuals vary, but I believe this is becoming more and more a do-it-yourself society. To me there is nothing more relaxing than going home and puttering with tools and doing something that is constructive around the house. It seems to me that industrial arts teachers could take the lead in initiating a home industrial arts program. This could be divided into the basic areas, including such fields as plastering, painting, plumbing, electronics, masonry and gardening. This would put some real life into the industrial arts program. Let it be clear that I am not, under any circumstances, suggesting that we abandon the fine program we have in our schools today. But I am saying that, in my judgment, much more can be done to make our industrial arts program more meaningful. It should be r[illegible] to everyday lives of boys and give them skills they can use the r[illegible] of their

Dr. Kaye is Assist[illegible] [illegible] ...sonnel, Minneapolis Public Schools, Minnesota.

F-14.1.1 AIAA
Forum of Innovations
INDUSTRIOLOGY—THE SCIENCE OR STUDY OF INDUSTRY
Chm., Jack Kirby; Rec., Edgar Hare; Speakers, George J. Brown, Duane Jackman, Jack Kirby, Jack O'Neill; Host, Dean G. Reiner.

INDUSTRIOLOGY— THE SCIENCE OF INDUSTRY

INDUSTRIOLOGY PHILOSOPHY

George Brown

The Industriology Project at Wisconsin State University is directed to the improvement of the course content found in industrial arts. Course content as taught is often far removed from what is found in industry. Industry's activities and processes have changed rapidly in recent years, but in contrast industrial arts content has been slow to respond. Therefore, the gap has widened between industry and the school.

The problem has two parts. The first is the rapid expansion of technology, and second is the obsolescence resulting from expansion. The curriculum project results from research, in-school try-out and a genuine desire to up-grade our present industrial arts instruction.

The explosion of technological advances has left a deep mark on industries. What might I use for an example? To select one or two is like selecting one or two grains of sand. But consider with me the impact of Sputnik, TV, computers or automation. Contrast this with the boy who today is adding shavings to the pile that I left behind some twenty years ago. Why should the hand tools of yesterday be contrasted with the power of today? Do you know a high school student who would prefer to use a hand drill as compared to an electric drill or who would prefer to walk instead of ride to school? Many industrial arts programs still copy drawings instead of seeking another approach. The individual project is often supreme, and certainly it is a part of our program, but there appear to be possible supplements to this method. What then should be the content for industrial arts?

In the past the content base has been selected from the trades, materials, activities, energies and professions. What is available to be taught is directly related to the scope and size of the content base. If the base is limited, it is natural to assume the content will be limited. Our traditional offerings have been closely associated with metals, woods and drawing. It is, of course, possible to have combinations of the traditional bases. Carpentry is associated with a trade and a material, or architectural drawing is associated with a profession and an activity. The size of the base for the first course offering in industrial arts is most important. At the lower level, the content should be broad and basic. If we add up the various bases discussed here, we have a composite picture of a whole with far more meaning to the student. It is believed the whole provides a better base than any single part, and the whole tends to resemble industry more closely. The Industriology Project makes use of industry as a base.

When we examine industry, it is possible to divide it in many ways. Traditionally, we could divide it into woods, metal, etc. But as a result of the Industriology Project, the division for Phase I has been made in terms of an economic cycle. The cycle includes: extracting, manufacturing, distribution and servicing. The introductory course is made up of content selected from the four areas. The freedom to select various content opens the door in aiding the student to interpret industry. Phase II gives the student an opportunity to study industry, Phase III gives him an opportunity to apply industry and Phase IV, the opportunity to enter industry.

The base for content has been challenged and the importance of various elements has changed. If tools are used as a measure, we find the shift to power operated. If materials are used as a measure, we find many new materials unheard of five or ten years ago. Compare a 20-year-old catalog from a mail order house with a current copy. What is the

difference? Compare the products now available to the consumer with those available to the consumer 20 years ago. What happens when we look at industrial arts offerings today with those taught 10 or 20 years ago?

Industriology is the science of industry, selected from a broad base, flexible to meet technological advances and meaningful to the student in a modern and complex industrial society.

INDUSTRIOLOGY STRUCTURE

Duane A. Jackman

As Dr. Brown has pointed out, Industriology may be defined as the science of industry. It is a broad study encompassing all industries. This brief definition, perhaps, is of no more help than many dictionary definitions, but it is apparent that the content for Industriology should reflect current industrial practice. We have been using a two-pronged approach to the study of industry.

Our industrial-economic system reveals that the total industrial complex is composed of four general types of industry: raw materials or extracting, manufacturing or processing, distribution and service industries. It is not possible to take industrial concerns and place them under one of the types of industry and say that it is this and only this type, but it is true that these four types of industry comprise the industrial complex. Some industrial establishments may be engaged in work in each of the four general types.

The other prong is concerned with the history, development and implications of industry as a vital institution in our technological society. An examination of industries reveals that there are basically six activities typically found in most industries. The six activities as we have stated them for use in the Industriology Program are: product development and design; internal finance and office services; manufacturing or processing (including production planning and control), quality control, plant services and plant engineering; marketing; industrial relations; and purchasing.

Industriology is planned so it is easy for teachers to use. It can be offered as a special area at any level of the secondary school. The various parts, which we call Phases, may be offered for various amounts of time. Indeed any industrial arts instructor could select portions of Industriology and present them as parts of his industrial arts classes. We would prefer at least a four-year study for one hour a day, five days a week. It may start as a special subject at almost any level in the secondary school. The total Industriology Program, of course, would begin when a child started attending school. In the elementary school the regular teacher would present the Industriology work. This program will be developed during the next year.

Phase I. The beginning study at the secondary level is called the Development and Structure of Industry. In this class a student will develop an interest in and an understanding of industry. Both the development of industry and its implications for modern society are included. The students will gain an understanding of the typical activities conducted in most industries as well as a general knowledge of the various types of industries today. Of course, as all industrial arts teachers would want, the students will acquire a degree of skill in the use of industrial-type tools and machines.

Phase II. Basic Activities and Processes of Industry is the second part of the Industriology Curriculum. This is where the content of the field is expanded. The student is expected to get a better understanding of the six activities of industry which were described above and their importance. He will have an opportunity to gain additional skills in and develop an understanding of many industrial processes. The student will increase his ability to cope with and solve problems of an industrial nature.

There is no end to the industrial processes which could be presented. It is hoped that industrial arts programs oriented around woods and drawing will present some processes from other industries to give students a better understanding of the scope of industry.

Phase III. Modern Industries. This phase is more like what is, and has been done in industrial arts programs. It differs in that an in-depth study of an industry, let's say the plastics industry, would be made. The study would go from the raw materials through manufacturing or processing, to distribution and service. Larger schools would be able to provide a greater variety of industries, from which the students' selections could be made.

Phase IV. Vocational and Occupational Guidance. We are still researching and

developing this part of the program. We expect students engaged in this phase of the program to study how to get and keep the desired job. They will know the preparation needed to enter an occupation and how to get promotions. Of course, they will develop a better understanding of industry and get some experience with industrial work.

Industriology, then, is intended to be a broad, comprehensive study of industry to include the four types of industries, the six activities of industry, as well as the history, development and implications of industry as an institution in our industrial society.

INDUSTRIOLOGY ACTIVITIES

Jack Kirby

The Industriology Concept has been in the development stages for the past 2-3 years. Initially the groundwork was laid through small discussions among staff members. A Prospective Teacher Fellowship Program during the 1966-67 school year provided an opportunity to enlarge on the idea and further develop the concept. In this program, students and staff visited a wide variety of industries to analyze and evaluate each industry for content for the Industriology Concept. These visits were day-long sessions involving observation, discussion and picture-taking. Following the visits, the materials were analyzed to establish the basic content for the concept. An Experienced Teacher Fellowship Program currently operating has continued the development of Industriology. More visits to industries were taken as well as specific instructional materials' being developed.

The heart of the Experienced Teacher Program, however, has been the internship phase. This has involved twelve cooperating schools in the Platteville area. These schools have provided industrial arts laboratory facilities in order to "try-out" and experiment with some of the activities for the Industriology Concept. Observations through visits and written reports have provided information concerning outcomes, problems, good features and other pertinent data.

I would like to illustrate and comment very briefly on some of the different activities that have been tried in the schools in an attempt to broaden and expand the study of industry. Lab activities are what we have been most concerned with, although visual materials such as slides and films, oral and written reports, field trips and reference reading, as well as typical industrial arts lab activities, have been a part of the program.

Mass production activities have played a large part in the lab activity aspect of this program. Mass production lends itself well to providing an overall understanding of industry, particularly the six activities as mentioned by Dr. Jackman. We have found that a mass production situation can be set up in any type of shop or facility. The mass production of plastic model cars was one activity used in this way. Although strictly an assembly situation, it did provide the students with the opportunity to study many facets of industry. Through such an activity, time and motion study, as well as other production considerations, can be studied. The students can see where certain jobs can be eliminated or combined. Jigs and fixtures also become important and can be integrated with other classes. Through mass production, a broad comprehensive study of industry is emphasized.

Bulletin board displays have been important and valuable activities for the students to help illustrate the different types of industry, as well as other important areas of study.

Paper-making has been an exciting and valuable experience for the students. Some have started with wood chips and chemically produced pulp while others started with dissolved tissue or Kleenex. The activity resembled home economics at times with flat irons, rolling pins and egg beaters as part of the apparatus. Other equipment may be quite simple, or we may even use metal working equipment to squeeze out water. The end result, however, is paper.

A different approach to drafting involved students' developing basic drafting skills while studying industry through the drawing of organization charts.

The casting aspect of industry has been experienced through a variety of forms. One group developed molds and cast root beer mugs. Another cast metal hammer heads. Research and development has been an activity in many of the schools. One school is experimenting with a furnace to make glass in order to study the glass industry better.

Concrete has been an area of study associated with the building industry. Casting of concrete products as well as researching of various cement mixes has been done. The carpentry aspect of the building industry has also been studied through construction of

models of various sizes. The architectural aspects have also been included as well as has dry wall construction.

Girls have also been a part of the Industriology program with the belief that an understanding of industry is necessary for all. The service industries have been studied with small engine repairs and maintenance as one type of activity.

These are indicative of some of the activities that have been conducted on a try-out basis in the Industriology Project. Most of them have been associated with the first phase of the program – the development structure of industry. Refinements and changes are anticipated. One approach that we believe has possibilities for this introductory course is to study raw materials industries using wood as a material, make paper, print stock certificates on the paper to study the graphics industries as well as corporate structure, to design and produce a product, to market the product, distribute it and service it if necessary. This, we believe, will provide for a broad comprehensive study of industry at the introductory level.

To support the activities of this program, numerous materials have been developed. Among these are a study guide, a teaching plan, a bibliography, a list of instructional aids and information and activity sheets. Much of this is in the revision stage at the present time.

What will be done with Industriology in the future? Work will continue on the development of the second, third and fourth phases. Continued up-dating of present materials will be done. Teaching materials, slide series and video tapes will be put into final form and made available to those desiring them. Additional teaching materials will be developed. Funds permitting, short institutes will be held to orient teachers to Industriology. Considerable evaluation will be conducted in order to develop the concept better. Of prime concern at the present time is the use of video tape to bring industry into the school.

INSTRUCTIONAL MEDIA SUPPORT

John O'Neill

The audio-visual aspect of the Industriology Project at this point in time includes five primary activities, and, of course, many secondary ones. The five primary activities are as follows: (1) local production of 2 x 2 color slides for instruction and for project evaluation; (2) 16mm motion picture evaluation; (3) aid to cooperating schools regarding their procurement of audio-visual utilization equipment; (4) organization of an Instructional Resource Center for materials useful in teaching the Industriology Concept; and (5) planning for the use of video tape and television in the project.

I would like to elaborate briefly on the first four of these points and conclude by going into greater detail on our anticipated use of television and video tape.

The greatest amount of time and effort thus far has been expended in the production and duplication of 2 x 2 color slides. The Industriology Project found it necessary to set up a facility for this activity, since previously no local production facility existed on our campus. Four scripted slide series have been developed this past year and each has been viewed by approximately 950 students. A series on raw materials has been completed and is available for loan. The series "The Industrial-Economic Cycle" and "Activities of Industry", both for use in the course titled Development and Structure of Industry, will be revised this summer. A series on service industries has been story-boarded, scripted and is now ready for shooting. Present plans also call for the development of 2 x 2 color slides to aid in the teaching of manufacturing and distribution industries.

As you have seen, many slides have also been made this year in the cooperating schools. The intent of this activity is to use these slides during the coming summer session to help evaluate lab activities.

This past school year has also found the project involved in the evaluation of 16mm motion pictures. We know from experience that catalog descriptions of films are usually inadequate, and for this reason we are in the process of evaluating six to eleven films per week in an effort to update the instructional aids list that accompanies all Industriology teaching plans. For this activity we are using an evaluation form and procedure very similar to those used by the Educational Film Library of America.

An attempt has also been made this year to up-grade cooperating industrial arts programs from an audio-visual utilization standpoint. Questionnaires were circulated to provide us with information on which to base recommendations to co-op school adminis-

trators regarding their purchase of utilization equipment such as slides, filmstrips, overhead and motion picture projectors.

The fourth primary activity has been to accumulate and attempt to catalog free instructional materials from industry. As you well know, there are literally mountainous amounts of these materials available, and each piece has a different size and shape. We are attempting to organize these materials as to their usefulness in teaching the Industriology Concept at various grade levels. An area in the Industriology Center will soon be designated for these materials, and they will be available for examination and short loan to any industrial arts teacher or prospective teacher in the immediate vicinity of our university.

The project also has plans for tapping the tremendous potential that video tape has for teaching in the area of industrial arts. Planning for equipment is actually past, since the project has purchased, and is waiting for delivery of, a complete broadcast-quality mobile television unit consisting of two television cameras, control and switching unit and video tape recorders. The package has been designed to fit into a conventional station wagon for transportation. The mobile unit can be operated by as few as three people, and since it is fully transistorized, its power requirements are low enough to allow practical operation almost anywhere.

Plans for use of this equipment include: (1) making video tapes of current industrial processes at industrial sites, with the tapes to be edited on campus and played back for Industriology classes; (2) making video tapes for Industriology lab activities for evaluative playback on campus; (3) making video tapes at the university for playback in elementary and secondary schools; (4) making video tapes at industrial sites for immediate playback in secondary schools or at the university.

The project developed these plans ten months ago and had anticipated that by this time, five or six productions would be ready for use. Unfortunately, however, administrative delays in purchasing at the state level, coupled with the manufacturers' inability to meet delivery dates, has resulted in our inability, as yet, to make a single production. Arrangements have been made with various industries in our area, and we do plan to start production in the very near future.

As the project develops, we intend to continue our efforts in the development of audiovisual materials. Before being made available to the public, however, these materials will all be classroom-tested. Funds permitting, our intent then is to make them available on a loan basis for teaching the Industriology Concept or for use in conjunction with the teaching of the more traditional industrial arts.

Messrs. Brown, Jackman, Kirby and O'Neill are on the Industriology Project Staff at Wisconsin State University, Platteville.

F-14.1.2 AIAA
Forum of Innovations
THE JUNIOR HIGH SCHOOL PROGRAM IN INDUSTRIAL ARTS—A STUDY OF INDUSTRY AND TECHNOLOGY FOR CONTEMPORARY MAN
Chm., Donald Maley; Rec., Donald Wilson; Speakers, Harley Smith, Len Waitkus, Edward Thacker, Frederick Eierman; Hosts, Karl Gettle, George Litman.

INDUSTRY AND TECHNOLOGY FOR CONTEMPORARY MAN

Donald Maley

The topic of this session will lead us into a number of interesting and noteworthy discussions of what has been called contemporary industrial arts. I would like to present a number of concerns regarding the nature and function of this area of study in a technological age.

As a starting point I am referring to industrial arts as it is defined by Wilber and Pendered in the revised edition of Industrial Arts in General Education:

". . . those phases of general education which deal with industry – its organization, materials, occupations, processes and products – and with the problems resulting from the industrial and technological nature of society."

This definition has yet to be exploited by much of the profession although such an area of study has broad and valuable contributions to make to the present society in terms of what content is to be taught. However, this is not enough. Industrial arts can assume a new posture and a radically new educational dimension if in addition to the content as defined above, it will devote its fullest potential in the direction of the development of people. Every area of the school has this same obligation. Yet, few have deliberately and soul-searchingly attempted to design educational experiences that would place this second dimension of education (the development of the human component) in its order of primary concern.

Our emphasis has been on "containerization education", which has as its fundamental function the memorization of certain selected minutiae out of an endless cosmos of information and the execution of selected educational minuets that have failed to come near meeting the human requirements for living in the contemporary age.

Specifically, have we been concerned with "learning how to learn"; the "processes of decision-making"; the "processing of information"; the "art of exploring change"; the development of a "sense of power" in each individual; the development of a "positive self-concept"; assisting the student in accomplishing his "developmental tasks"; and developing the "art of self-renewal"; in essence the development of the human qualities that will enable him to function truly as a human in keeping with the needs of society. A new industrial arts can evolve from such a commitment, and in doing so, it (industrial arts) will do a much better job on the content of a study of industry.

Inasmuch as I have not come here to make a complete lecture on the topic, I would like to leave you with the following suggestions for the development of "new industrial arts" as an area of study for all the schools' clientele.

(1) It must put the content and context of the previously cited definition into the matrix of industry that exists in 1968 and the years ahead.

(2) Industrial arts must concern itself with the sociological, psychological and biological processes associated with the "developmental tasks" of youth and endeavor to assist in such development in a meaningful way.

(3) Industrial arts must concern itself with a range of programs and activities that reach all levels of students with their varying forms and levels of giftedness or ability.

(4) Industrial arts must concern itself in its structure of learning experiences with the nature of the individual in the inner city, in Appalachia and in rural America, as well as in Bethesda, Maryland, or Shaker Heights in Cleveland.

(5) It must take its cues and establish its design of educational experiences from the major and contributing curriculum studies of the day, such as the recommendations that came out of "Project Instruction" sponsored by the NEA.

(6) Industrial arts must concern itself with the needs of man in the contemporary society—needs that relate to citizenship, mobility, continuous self development, social, political and technological adjustment, the needs for identity and the need to be informed.

(7) Industrial arts in the years ahead can make an increasingly important contribution to the future if it is willing to assist the total educational program in its dire need to fill the communication and "functional" knowledge gap that continued to get wider and wider between the technologists and the vast citizenry of the nation and world. There already exists grave concern for a future governed by a "technocratic elite."

Finally, I would want to remind you that the children in our junior high schools today will be only forty-five years old by the year 2000. It is predicted that only two to five percent of the population will be needed to produce our goods. Great cities of the nation will be joined into one continuous mass of urban living. Technologists will be replacing the social engineers in the attack on social problems. New and radically different modes of transportation, foods, clothing, housing and entertainment will be commonplace. The human life span will be significantly increased, and the use of drugs for the control of behavior will be more widespread. It will be an age of new materials, new processes, new educational technology and, above all, a vastly different kind of daily existence.

This is what a "new industrial arts" or any form of education that may be around at that time has to look forward to in the years ahead. Whether a "new and useful industrial arts" can become a reality will depend upon the wisdom of the present leadership; a

continuing dedication to self-development by teachers, supervisors, administrators and teacher educators; and a willingness to pursue bold and radically different educational involvements with industry, technology and man.

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A UNIT FOR ANTHROPOLOGICAL STUDY OF TECHNOLOGY

W. Harley Smith

It seems that the leaders and thinkers of our profession have spoken very decidedly in favor of drawing our content from industry and technology. The support presented for this position is virtually indisputable in that it is concentrated in two well-founded points. The first: generally, the profession believes that industrial arts is a part of general education. As such it should contribute towards transmitting and interpreting the culture of our society. The second point: industry and technology are dominant elements of our modern society. It is worth noting that this second point describes a characteristic which is not unique to modern society.

Melvin Kranzberg, professor of history at Case Institute of Technology, has written, "Man has always lived in a technological age inasmuch as his life and culture have always been bound up with technology."(1) Technology is perhaps the most basic of human characteristics insofar as it is a product of human creative imagination and human skill, and more so because it has had a significant impact upon human society and its development. Perhaps one might very reasonably conclude that the advancement of civilization has been highly dependent upon man's technological achievements. It is partly because of this conclusion that we have taken the stand that an anthropological or historical study of technology should be part of the general education curriculum.

Happily, we do not feel alone in this position, as many creditable people have expressed the same belief. It is beyond the scope of this presentation to include the multitude of quotations available, but a partial list of advocates would include such historians and anthropologists as Sherwood Washburn, Roger Burlingame, Melville Herskovitz, Howard Mumford Jones and Melvin Kranzberg. It is the consensus of these people that to ignore or to slight the study of our industrial society as it relates to the past technological achievements would be in a large measure failing to provide for the individual's understanding of our industrial-technological world and how it became what it is today. I believe that general education is failing to provide for the individual's understanding in this area.

It has been observed by some of the proponents of the anthropological study of technology that technology is scarcely given more than a passing mention in history, social science and literature classes. The interest in the past has been focused almost exclusively upon eras, statesmen, generals, rulers and kings. Not only is there a void here which industrial arts can fill, it is a void which perhaps industrial arts is best suited to fill. The industrial arts laboratory provides students with an opportunity to deal with technological developments on a first-hand basis, experiencing many problems related to technological development; and using tools, materials, intelligence and human skills - the elements that are essential to technological development.

It is my objective this morning to present to you a successfully proven method by which students may, in an industrial arts setting, have a good opportunity to learn how man has developed ways of changing raw materials into devices which have made his way of living easier and more enjoyable. However, before I begin to describe how such a study might be conducted, allow me to point out to you where the anthropological study of technology is placed within the entire junior high school program that is being presented here and why it has been so placed.

The anthropological study of technology has been placed at the beginning of this program, in the seventh grade. We feel this is appropriate because it enables the student to understand how and why our Western civilization developed into a highly industrialized civilization – a seemingly good understanding to grasp before studying modern America

ndustry. The approach to instruction utilized in this phase of the program was also elected with consideration to logic. The approach is the unit method, one which is not trange to seventh graders, as it is widely used in elementary school studies. Learning heorists tell us that the unit method is extremely effective at this grade level. Let us ow consider how the unit method of teaching has been utilized in an anthropological study f technology.

The development of technology may be studied under three broad and comprehensive nit topics, each dealing with historically and socially significant areas of technology. These unit topics are:

(1) The development of tools and machines and their contribution to the growth of civilization.

(2) The development of transportation and communication and their contribution to the growth of civilization.

(3) The development of power and energy and their contribution to the growth of civilization.

Because this is a highly student-centered program, students become actively involved s quickly as possible. However, the teacher initiates the study by orienting the class to ne activities in which they will become involved. He also stimulates interest by showing echnology-related films, by exhibiting some results of previous student activities or by sing other motivational techniques. The students first become involved in discussing nd campaigning which culminate in a democratic class selection of one of the three sug-ested unit topics. Under the chosen unit topic, each student will select a sub-topic or echnological development for his individual attention. However, in order for the student o make a selection of a sub-topic according to his individual interests and desires, he eeds first to know what sub-topic possibilities there are.

The student recognizes a need for using the resource materials available to him for reliminary research. His task is to compile a list of appropriate sub-topics which he ould consider pursuing. He may make use of home, school and community libraries. n compiling his list he may utilize books, pamphlets, bulletin board exhibits, charts or ven his previous experiences with trips, movies and television. Upon returning to the lass, the student would draw from his own list to contribute to compiling a class list. With the teacher's help the class may eliminate some of the proposed sub-topics out of ecognition that certain ones do not contribute to the unit topic as well as others. Seventh-rade sub-topic lists have reached enormous length for all three of the recommended unit opics. However, for the sake of example, let us consider the area of tools and machines o see what some of the possible sub-topics might be. A few that have been selected by tudents include: the lathe, hand drills, water raising devices, cotton gin, reaper, spin-ing wheel, catapult, power loom, drop hammer, fluid pumps, drilling rig, tread mill and rinting press.

Once selections have been made, the students focus their attention on their individual ub-topics. This stage of the study witnesses the student very eager to construct some-hing that depicts the sub-topic he has chosen. He may desire to construct a replica, a emonstration model, or a developmental sequence of models. He soon discovers that in rder to develop plans and drawings by which he may construct his project, there is a eed to become more informed about the operational and constructional aspects of his ub-topic. Home, school and community libraries become valuable sources, as do muse-ms, historical societies, government agencies and industrial concerns. Letters, phone alls and visits provide the information needed to complete the project.

As the research and construction activities proceed, student-centered seminars be-ome a valuable tool in the class unit study. Periodic seminar meetings, under the direc-on of a student chairman, provide excellent opportunities for students to exchange ideas, o seek help with research and construction problems, to assist one another and to learn bout each of the other class members' sub-topics. This last value of the seminar is ealized through oral presentations by each student over the period of the unit study. One purpose of the report is to convey to the class what the student has learned about the istory and development of his sub-topic, including its contribution to the people of its me period and possibly to modern civilization. Also of significance is the conveyance f the technical and scientific factors which are related to the sub-topic. The student also nforms the class of the research procedures he has used, the informational sources he as used, the problems he has solved, and the tools and materials he has selected in the onstruction of his project.

The seminar, along with the other major elements of the anthropological unit study –

namely the laboratory experience and the pursuit of information – provide... the student with the opportunity to participate actively in a wide variety of educational activities These activities include researching, inquiring, analyzing, planning, organizing, creating, constructing, experimenting, evaluating and reporting. As the provision for a wide variety of educational activities would suggest, the program that my colleagues and I are presenting here is one which has been formulated with a great deal of consideration given to the development of individual abilities as well as to worthwhile content.

FOOTNOTE

1. "Technology and Culture: Dimensions for Exploration". Melvin Kranzberg. AIAA Bulletin No. 6, 1964.

Mr. Smith is Industrial Arts Teacher at Rollingcrest Junior High School, West Hyattsville, Maryland.

THE CONTEMPORARY UNIT IN INDUSTRIAL ARTS

Lorin V. Waitkus

One of the areas of study in the ninth grade of the Maryland Plan is contemporary units. In this program the student studies the newer innovations which comprise our present technology and how these innovations may affect industry. The unit method is the approach used to study the contemporary areas. The unit method is an experience in which the teacher and the students work together in developing a unit around a certain topic, theme or field of inquiry (1, p.159). Some of the contemporary units might include plastic injection, urethane forming, furniture construction, electrical discharge machining powder metallurgy, etc.

Although there is emphasis on the development of contemporary technology, development of the individual is also stressed.

Before discussing the study of contemporary units, it is necessary to know first what researchers have learned about the individual, or the self, and, second, what has been learned about modern technology.

If industrial arts education is to be effective in obtaining desirable student behavior it is necessary to know something about the individual, or the self.

Richard M. Brandt states that the self is the most useful concept yet developed in explaining behavior. He lists six important hypotheses regarding the self.

(1) The urge to learn seems intrinsic in the individual. This is apparent when observing the eagerness and exploratory behavior of the students. For some reason school people fail to capitalize on this natural tendency. John Holt brings this issue to focus when he says, "What we need to do, and all we need to do, is bring as much of the world as we can into the school and classroom; give children as much help and guidance as they need and ask for.... We can trust them to do the rest." (5,p.189)

(2) An individual strives to feel comfortable. Children learn more than facts and ideas, they also learn likes and dislikes. A student who is continually made to feel uncomfortable in learning skills in industrial arts classes may continue to resist doing those skills even if he has mastered them.

(3) If an individual is accepted it helps him grow and change. When an individual is threatened in a learning situation, frustration may become too great and growth may be stopped.

(4) Changes in perception will help the individual change the self. Freedom must exist so an individual can explore various viewpoints and relate personal meaning to various experiences.

(5) Individuals strive for consistency. Integrating ideas helps the individual to integrate himself.

(6) Change in an individual's behavior will occur only with changes of the self. Teaching takes place only when change occurs in the individual. (3, pp.24-33)

The urge to learn which seems to be in an individual should not be destroyed. Neither should the desire to investigate new ideas or experiment with the unknown be stifled. It is limited only by others' rights. For then, the very goal of seeking desirable behavior change in an individual is made unattainable. It really is not so much what new technologies are studied in the contemporary unit as the spirit in which they are studied.

Industrial arts laboratories are not the only place where emphasis is being placed on the individual. Norbert A. Walent, industrial engineering supervisor with Chicago Aerial Industries, Inc., says, "The most valuable resource in any organization...is the individual. I've always believed in providing the broadest responsibility and authority limits at the lowest working level within a professional group. With some guidance, most individuals will surprise...others if they are allowed to use the full range of their abilities and if they are given a full measure of responsibility." (4, p.11)

An awareness of a favorable climate in which students can learn is incomplete until the role of a teacher is also modified. With better written materials, improved communications, public libraries, museums, technical reports, information from industry and greater use of community resources, the teacher's role becomes one of director rather than teller. William B. Ragan's statement accentuates this point: "The teacher's role becomes less that of giving information and more that of coordinating and guiding the learning that comes from many sources. This process requires a great deal more professional skill than merely hearing lessons and giving out information." (6, p.484)

The teacher's role of becoming a director or coordinator of learning rather than a dispenser of facts has come about partly as the result of the knowledge explosion in technology.

Gene Beaudet, editor-in-chief of Iron Age Magazine, says, "Technological advances that took 500 years have been collapsed to 25 years. In ten years, three out of four workers will be putting out products not now on the market – or even known." (2, p.5)

Ralph E. Winter reports in the Wall Street Journal that: "Electron guns, lasers, super magnets, electro-chemical tools and ultrasonic vibrators, recent products of the research lab, are making their factory debuts." (7, p.5)

In short, industrial arts curricula should exist where students can, in their way, to the level of their ability, and in keeping with their interest, discover the knowledge and understanding that will provide for their continuous change and growth.

The preceding discussion has disclosed some of the thoughts psychologists suggest are known about the individual. The technological society as some observers see it has also been described. It is now possible to discuss clearly how the contemporary unit is achieved.

The contemporary unit centers around certain basic elements which provide a student with a better understanding of the latest technological developments and how these developments aid man in his mastery of materials and processes.

After the unit has been selected, the student chooses a topic within the unit. He then researches his topic, presents an oral and written report, and constructs a model or representation of his particular topic as his project.

When the student begins making his study, he soon discovers the many sources of information that are available. He gains knowledge by reading technical reports, telephoning and writing to engineers in industry, reading technical journals, and obtaining materials from industry. The information that he gains helps him in preparing drawings and plans necessary to complete the project.

Although written and oral reports are completed by the student, the greatest part of the time is spent in constructing the model or display. As he collects data and constructs the project, he discovers how other technological developments and scientific principles prompted the discovery of his particular topic. Sources of information, methods of inquiry, research techniques and reporting procedures are exchanged by the students through student-conducted seminars that are held periodically.

The contemporary unit provides a method whereby students are engaged in three broad educational ventures: research, planning and construction.

In using this method to study contemporary units, teachers can make use of their understanding that one child differs from another child in various respects, for example, in background, in goals, in interests, etc. There can also exist an opportunity for intelligence and talent to be expressed in many different ways.

In conclusion, tools and machines are vital to our strength as a nation. There are visible tools such as saws, hammers, lathes, numerical control machines, plasma arc, etc. But equally important are the invisible tools of thinking, inquiring, investigating,

analyzing and relating. The greatest resources that can exist are the skills people hav in their heads and in their hands.

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F-14.1.4 AIAA
Forum of Innovations
THE CENTRAL MICHIGAN UNIVERSITY PARTNERSHIP PROJECT
Chm., H. James Rokusek; Rec., Carl E. Frankson; Speakers, Ernest L. Minelli, Thomas M. Benton, William Holloway; Host, Robert L. Baumgartner.

THE CENTRAL MICHIGAN UNIVERSITY PARTNERSHIP PROGRAM

Thomas M. Bento

Even a superficial examination of the socio-cultural scene within this country toda leaves little doubt that the formal educational experience provided a large majority c youth is totally inappropriate to their needs. As startling as this statement may seem, is supported by numerous facts. For instance, it is supported by the fact that approxi mately 50 percent of the youngsters who enroll in the ninth grade each year either dro out before high school graduation or in other ways reject the education offered.

It is supported by the fact that large numbers of youngsters who satisfactorily com plete the requirements for high school graduation are so poorly prepared they can neithe meet the demands of existing jobs, qualify for appropriate training programs, or gai admission to programs of higher education. They have been led into vocational and edu cational dead-ends.

It is supported by the fact that, each year, thousands upon thousands of capable yout who are adequately prepared at the high school level find no access to further training o education appropriate to their needs. These youngsters are forced out of the education system prematurely and forced into vocational roles well below their level of abilit and interest.

Finally, it is supported by daily news reports which tell us with increasing frequenc of the rebellion, violence and corruption which sweep our land as rapidly-growing masse of unemployed, unemployable and underemployed youth – the products of our education system – give vent to their feelings of hostility and frustration. Economically, socially an psychologically destitute, these youngsters join the ranks of the alienated poor, who burde our economic resources, severely strain our social and political structure, and threate the very existence of our democratic way of life.

Unfortunately, the situation promises to grow even worse. The myriad of scientifi discoveries and technological advances taking place within this country leaves the voca

ional world in a state of constant change and growing complexity. Specific skills and :nowledge grow obsolete overnight as new jobs replace old. At the same time, the newly-:reated jobs demand less and less "manual" and more and more "mental" facility. To ›e employable, the citizen of tomorrow must not only be capable of adapting to a variety ›f vocational tasks, but he must also be able to apply himself effectively to increasingly lifficult ones.

Without doubt, the breach between vocational competency on the one hand and formal :ducational preparation on the other is widening. For the most part, our present educa-ional system simply is not attuned to the demands of the times, and the learning experi-:nces provided within this system have little meaning for youngsters who must compete vithin a world of modern technology. If we are to end this tragic waste of human poten-ial and remove the social, economic and political stresses which threaten our destruc-ion, we must make significant educational changes and we must make them now. It would ›ppear that the most urgent of the changes needed are as follows:

(1) Students must be given greater assistance in building realistic vocational goals. Far too many young people are drifting through their educational experience without voca-ional goals and without educational purpose. Better programs of occupational orientation ›re a must.

(2) The formal educational experience must be shaped to the ultimate demands of ›ocational goals. Not only must we shape the overall curriculum to the demands of a com-›lex 20th-century culture, but, within this, we must also see that each individual's educa-ional experience is relevant to his general area of vocational interest and appropriate o his level of ability.

(3) The educational experience must be balanced between vocational and general ›reparation. Although manual skills retain a degree of importance, they are becoming ncreasingly inadequate within themselves. Indeed, vocational preparation for a world of apid change and growing complexity demands a sound fundamental education which has ;eneral application and protects against vocational and educational dead-ends.

(4) The educational experience must be individualized. The curriculum must be haped to individual needs, and students must be encouraged to progress toward their ›ocational and educational goals at individual rates.

(5) The educational experience must be continuous and smooth from the very begin-ing into initial employment. Neither educational voids, dead-ends nor mechanical ob-tacles should be allowed to discourage or interfere in any way with the individual's rogress toward a vocational goal. We must develop visible and inviting avenues of :ducational preparation appropriate to the needs of all individuals regardless of their ocational interests or academic abilities.

(6) The student must become intimately involved in the educational experience. The tudent must become an active learner rather than a passive observer. The memoriza-ion and regurgitation of previously digested facts and figures is superficial, meaningless nd largely useless. Students must become involved in the isolation and definition of ignificant problems, the collection and analysis of data, decision-making and the practical pplication of knowledge to life's tasks.

(7) The total educational experience must be integrated and unified. Education today s little more than a vast collection of isolated fragments which are extremely difficult o comprehend, retain, relate or apply. If formal educational experience is to be mean-ngful and have any practical value for the student, the traditional barriers which isolate nd fragment must be removed and all facets of educational experience must be inter-elated.

Only through educational programs having these characteristics will youngsters attain he applicability and adaptability necessary for effective functioning within the complex, echnical world of the late 20th century.

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PARTNERSHIP PROGRAM DESCRIPTION

Ernest L. Minelli

Today, in secondary, community college and university classrooms across lower Michigan, groups of teachers and pupils are experimenting with an exciting new instructional program.

It all began in the summer of 1965 when certain of Michigan's secondary schools, community colleges and industries joined forces with Central Michigan University and The Ford Foundation in the establishment of the Partnership Education Program, a cooperative effort dedicated to and taking as its major objectives the organization, fostering and support of a program of education which would encourage and enable all youth to attain a meaningful and appropriate education regardless of their individual abilities or vocational goals.

The new Partnership Program, based on a theory of education which is (1) logical in structure, (2) cognizant of current psychological findings and (3) guided by a consistent philosophy of education, was designed specifically to improve the quality of industrial-technical education courses, the quality of instruction, the articulation from one phase of education to another, and the application of knowledge through correlation of industrial-technical subjects with other academic areas.

The Partnership Program is a plan for developing new industrial-technical education programs designed to prepare more and better qualified teachers and better qualified individuals for careers in industry, provide upgraded in-service education for teachers, and improve and enrich curriculum programs of industrial-technical education, both at the secondary and higher education levels.

The new program emphasizes educating for the present and future, beginning with the secondary schools and continuing through the community college and the university. Functioning at all three levels - university, community college and high school - special emphasis is on an interdisciplinary approach inter-relating industrial-technical education with other academic areas.

The high school plan was designed to offer students basic industrial-technical training leading to a fuller comprehension of present-day technology as well as stimulating them to continue their education.

The program is intended to appeal to all youth regardless of abilities and talents. Effort is made to allow for differences in abilities, interests and needs, as well as to afford learning experiences which are most significant for the success of each individual.

The industrial-technical courses have their content cast in science, mathematics and English. The natural relationship of each subject to the others is drawn out and used for augmenting knowledge and for the constant reinforcement of the relationship between the vocational and the academic subjects.

In the ninth or tenth grade, the program consists of "The Study of American Industry". At these grade levels students see and experience the unity or wholeness of modern industry. Opportunities to study the underlying functions of industry and explore their inter-relations are provided.

During the eleventh and twelfth grades the program consists of a two-year sequence of four major courses in the subject areas of English, science, mathematics and industrial-technical education.

The natural relationship of each major subject to the others is drawn out and used for constant reinforcement. The inter-relationships between the subjects are taught as an addition to the objectives of the courses themselves.

The high school program uses the vocational interest of the student as a motivating force in leading to a sound educational program, but the vocational interest does not result in an educational dead-end.

In the partnership community colleges, the program was designed to give the student proficiency in his selected field of technology, augmented by mathematics, basic sciences, English and technological principles relative to his selected field. In order to provide proficiency in these areas and more meaningful experiences to the student, an inter-disciplinary approach is used.

While many of the students in the participating community colleges will probably seek the two-year associate degree, transfer to the university is open to those wishing to earn the bachelor's degree.

Under the University Five-Year Plan, students have considerably more internship

teaching experience than normally. In addition, on-the-job industrial internship experiences are provided.

The first two years are spent on campus in a program especially suited to the needs of each student and the challenge of our times. The remaining three years consist of alternating semesters of on-campus and off-campus on-the-job paid internships.

The major part of the university program during the student's freshman year is made up of a two-semester inter-departmental sequence. This major inter-departmental sequence includes the subject areas of English, physics and chemistry, mathematics and industrial-technical education. Instructors from the four major subject areas function as a team to organize the content and evaluate the student's work.

The second year is devoted primarily to general and specialized education. In the alternate semesters, during the remaining years on campus, general and special education continue to constitute a large proportion of the student's program.

In each of the three off-campus semesters, the student both learns and earns as a full-time intern of a selected partnership school or industry. The student interns for two semesters in a selected school and one semester in a partnership industry.

In addition to the three-semester internships, the student spends one ten-week summer full-time internship both as a learner and employee in a partnership industry.

In summary, believing that the educated citizen is an integral part of our rapidly expanding technical society, Central Michigan University, participating schools and community colleges have discarded traditional curricula and instructional methods and have taken a fresh new approach in an effort to provide youngsters with educational experiences in keeping with individual needs and the demands of our times. To provide such experiences, the program incorporates the following principal features:

(1) The curriculum is vertically articulated.
(2) The curriculum is shaped to the demands of individual needs.
(3) The curriculum offers a balanced program of specialized and general education.
(4) The curriculum is horizontally correlated.
(5) The curriculum is individualized.
(6) Learning experiences stress intimate pupil involvement.
(7) The educational program is a partnership effort.

Finally, the Program demands of its individual curricula that which provides for and emphasizes imaginative research and experimentation by its students, and curricula where rote skills are only a part of its body.

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SOME ASPECTS OF THE SECONDARY SCHOOL PROGRAM

William H. Holloway

The Bridgeport Community School district responded enthusiastically to Central Michigan University's invitation to join them in a new curriculum venture. Subsequently, a team of four secondary instructors representing English, mathematics, science and industrial arts was sent to Mt. Pleasant, Michigan, to participate in the curriculum workshop in the summer of 1965. For six weeks on campus and for two weeks at the home district fourteen such pilot school teams planned the emergence of experimental courses to be tested in the 1965-66 school year.

It is important to understand that the conceptual framework within which we functioned was characterized by few working limitations. This facilitated the necessity for individual teams to make adaptations to local needs and conditions and was considered a prime asset to the task at hand. Wide and rapid divergence of each team's planning was a further result of the flexible requirements relating to local need.

For purposes of clarity the guidelines are briefly stated as follows:

(1) Each team was to be prepared to develop and implement a two-year curriculum at the secondary level, preferably grades eleven and twelve.
(2) Each team was to be represented by instructors in four disciplines (English, math, science and industrial arts).
(3) Each team was to stress horizontal articulation within the four disciplines.
(4) Each team was to modify the industrial arts course cooperatively, emphasizing

application of scientific principle as a conceptual scheme for exploratory experiences.

(5) Each team was to develop a four-course sequence directed toward the fulfillmen of needs of a specific population.

The original intent of Bridgeport's program was to provide highly motivating experiences for students whose grades (low) did not correlate well with their tested abilitie (high average). This category of student presented a real challenge since the general program had for all practical purposes failed to manifest their latent talents. In this respec the newly devised formula was unanimously successful. However, satisfaction was tempered by a failure to isolate causative factors. Prevailing opinion did express the vie that a "Hawthorne effect" could not have consummated the total observed change.

In mid-August the team returned to the home district for the final two weeks of work. Before them lay several major tasks to be accomplished, some of which would need to b completed prior to the opening of school. These could be summarized as follows:

(1) Complete student selection and schedule changes.
(2) Develop and initiate a plan to orient parents to the objectives of the new curriculum.
(3) Establish articulation with representatives of business, industry and other community agencies.
(4) Establish articulation with community colleges and other agencies to formulat a broad range of potential, post-secondary goals.

Each of these was ultimately accomplished to the satisfaction of all individuals involved. Further, each is considered highly worthwhile in a change of this magnitude an is thereby recommended to others. Two deserve additional, brief treatment.

The selection criteria for the eleventh grade students (all boys) were exceedingl simple, yet quite effective:

(1) Students would optionally elect the four-course, correlated program for two years
(2) Students had demonstrated average to high average ability as indicated by verbal/numerical Differential Aptitude Test score approximating the 80th percentile.
(3) Students had completed the first year of algebra regardless of attained grade
(4) Previously attained grades (in major subject fields) were significantly less tha average.

Selection of a potential group of students (approximately 80) was accomplished b searching individual records. Ultimately the plan evolved into a group of twenty-one students ready to begin studies.

The promotion of parental understanding, cooperation and support was deemed a essential function of our total effort. Again, the plan was simple but effective:

(1) A pre-school (late August) parent meeting was arranged to explain the progran of studies and the contemplated changes we hoped would evolve.
(2) A mid-year meeting was scheduled to give a preliminary report on progress an to obtain feedback on results observed at home.
(3) A year-end meeting was held for the purpose of giving a final report on progres and to complete arrangements for the ensuing year.

The support elicited with these simple techniques was gratifying to the staff. Bu more than that, it seemed we had in some manner touched upon a very basic and unanswered need. Attempts to isolate the prime mover were largely unsuccessful. Staf conjecture ran the full gamut of possible reasons with greatest agreement focusing on th combination of meaningful, exploratory experience and the establishment of worthwhil post-secondary goals other than four-year professional training.

More specifically, the project and the student program had been tailored to meet individual needs. In doing this the team attacked many of the existing practices held in hig regard by many of our esteemed colleagues. If a thing "had always been done that way" it was suspect and we attempted to change it. A sampling of such practices, though brief will perhaps serve the purposes of this paper.

We discarded any and all forms of the traditional, student-assigned textbook in English. In its place we ordered individual subscriptions to two technically-oriented periodicals. Industrial arts projects were reoriented to applications of scientific principles encouraging demonstrative, prototype models. Instances of individual projects were deemphasized in lieu of team or small group projects. We requested oral or written projec reports instead of themes. The language instructor helped with reading in the physic text and the mathematics instructor assisted with problem solution in science. Not ever

venture was a success but more was gained than lost by our all-encompassing effort. Our continued and growing faith in the horizontally articulated approach is evidenced by the Title III, ESEA project, which has only recently been approved for this district. This project should provide the badly needed resources to expand, explore and implement a broader range of exploratory, occupational experiences culminating in a well-defined secondary curriculum for pre-technical education.

Mr. Holloway is Director, Title III, ESEA Project, Bridgeport, Michigan.

F-14.1.5 AIAA
Forum of Innovations
INDUSTRIAL ARTS CURRICULUM PROJECT: PROCEDURES AND PROGRESS
Chm., Donald G. Lux; Rec., James W. Fristoe; Speakers, A. Dean Hauenstein, Robert E. Blum, James J. Buffer; Resource Persons, Jack D. Ford, Ronald L. Koble, Ralph Ressler; Host, William L. Guthrie.

FIELD TESTING THE I.A.C.P. TEACHING-LEARNING SYSTEM

Robert E. Blum

In planning any curriculum development effort, provision may be made for trial and evaluation of the instructional program. Trial and evaluation in curriculum development must be thought of as being similar to pilot testing a new industrial product such as an automobile or an airplane. The program is put into operation on a limited basis and then it is evaluated in terms of how well it operates in the environment for which it is designed and also in terms of how well it causes the desired changes in student behavior. The results of the evaluation are then used as a basis for revising the program so that it will function more effectively within the environment and at the same time cause even greater student growth in terms of stated objectives. This process is like testing a new model of an automobile on the company's test track and then making adjustments to the design based upon the results of the test. Unfortunately, in past years little effort has been devoted to actual field testing, evaluating and revising of instructional materials and experiences in the field of industrial arts education.

As a field testing program is planned, two basic questions must be answered: (1) What information is needed by the curriculum decision-makers in order to make conscious, intelligent decisions regarding program revisions?; and (2) How can the required information be obtained? It is possible to collect volumes of information regarding a new school program. There are probably hundreds of different pieces of information which could be collected; in fact it would be extremely easy to collect so much information that it would become meaningless in terms of improving the program.

We in the Industrial Arts Curriculum Project have attempted to identify those items of information which will be most valuable in making decisions about program revision. We are also attempting to establish an evaluation system which will result in the collection of those pieces of information which are deemed valuable and in the use of every piece of information collected. The following instructional materials and procedures are being tested and evaluated:

(1) Textbook
(2) Workbook
(3) Laboratory manual (procedures for student activity, directions for student activity and material and tool lists)
(4) Teacher's guide (objectives, teaching procedures, teaching aids and materials and tools lists).

In addition to determining what to evaluate, it is necessary to establish some criteria against which to evaluate the materials and procedures. The following are the general criteria for evaluation which have been identified and are being used in the Industrial Arts

Curriculum Project:

(1) Content – completeness and accuracy
(2) Time – correctness of allocations
(3) Interest – appeal to students, teachers and other interested individuals
(4) Ability – appropriateness for students.

Probably the most serious problem related to evaluating instructional materials and procedures is obtaining consistent, accurate data based upon controlled trial and observation. This problem is related very closely to the problem of determining the deficiencies which exist in the instructional materials, what affect the deficiencies have upon student learning, and what changes are needed to correct the deficiencies. It may seem easy to develop a few observation forms and have trained persons observe the instructional procedures, make judgments about the effectiveness of the procedures and, based upon findings, list several changes which would improve the procedures. However, if an observer witnessed a sequence of events during a 45-minute period of time which included teacher presentation, discussion and student activity, would he be able to identify the deficiencies, know the effect of such deficiences and list the changes necessary to overcome the deficiencies? And if this problem is compounded by adding out-of-class work related to the same topic as well as individual differences, the task becomes almost impossible.

We must do the best possible job making intelligent guesses about program deficiencies and the best ways in which to overcome the deficiencies with the resources available for this purpose. We in the Industrial Arts Curriculum Project have decided that the person who is most likely to provide the best evaluative information is the teacher. Therefore, the pilot teachers evaluate the instructional materials and procedures daily, using the evaluative criteria listed above to provide the information required for making program revision decisions.

A second and vitally important aspect of program evaluation is achievement testing. The Industrial Arts Curriculum Project is including an achievement test series in the instructional system.

Identification of the pilot teachers as the primary source of data, other than student achievement information, along with establishing an achievement testing program, is actually a start toward answering the second basic question relating to pilot testing: How can the required information be obtained? Before establishing the specific procedures for collecting data from field testing, it was necessary to establish a basic rationale for the field testing program. The following points summarize the Industrial Arts Curriculum Project's rationale for field testing:

(1) Geographic coverage of the United States would be sought.
(2) Generally, greater involvement than participation by one school would be solicited from a school system.
(3) Coordination within a given geographic area is vitally important to program success.
(4) Because of a wide geographic spread, provision for centralized visitation within a geographic area and centralized data reduction within a geographic area are essential.
(5) Provision must be made for several teachers within a geographic area to meet together and work out the problems related to initiating a new school program.
(6) Teaching of the Industrial Arts Curriculum Project course should be the teacher's primary responsibility.
(7) Provision should be made for feedback from individuals as well as groups within a geographic area.

With the rationale established, it was decided that a field center approach would be more feasible than an individual school approach. Figure 1 shows a field evaluation center. The Industrial Arts Curriculum Project was initiated in three field evaluation centers during the 1967-68 school year and three additional centers will be added for the 1968-69 school year. In addition to the six field evaluation centers, a demonstration school will be operational during the 1968-69 school year. Figure 2 shows the geographic distribution of the field evaluation centers.

With 48 teachers in six widely-scattered field evaluation centers involved in evaluating the instructional materials daily, it becomes necessary to develop an efficient system of data flow and communication between the IACP Headquarters in Columbus and the centers. The original source of feedback is the teachers within the 24 schools. These teachers analyze the materials every day and complete a series of forms and make written

comments directly upon the instructional materials. At the end of each week, the field staff members within each center meet together in a seminar. The individual feedback is collected and the group then identifies the most serious problems which seem to be common to most members. After the primary problems are identified, the group brainstorms ideas for solving the problems. The head teacher then summarizes the ideas from the seminar in a weekly report and forwards the individual feedback and the weekly reports to Columbus. Also during the year, each teacher administers achievement tests. The answer sheets are sent directly from the teacher to Columbus. The global view of this feedback system is shown in Figure 3 and a more detailed view of the operation within a center is shown in Figure 4.

A question which probably has formed in many of your minds is, How are industrial arts teachers prepared to teach a completely new course and to evaluate instructional materials? This is a fair question and an important one, because industrial arts teachers usually do not learn how to teach construction and manufacturing in teacher preparation programs nor do they learn how to evaluate curriculum innovations. Because teachers are asked to perform many new tasks, the teacher preparation program becomes highly important.

Teacher preparation is an integral part of the field testing program. It is the goal of the teacher preparation program to develop teachers in-service who are fully capable of conducting and evaluating the IACP courses. Teachers who have undergone a traditional teacher education program must be oriented to the IACP rationale, the structure of industrial technology as a body of knowledge, the IACP instructional system, a different and more rigorous daily routine, a classroom organization which reflects industry, many teaching techniques which are not generally utilized in industrial arts courses, and the techniques for evaluating the instructional program.

The teacher preparation program is initiated in the spring of the school year preceding the installation of the IACP courses and will be a continual process throughout the field testing program. The first contact is a two-day orientation session in the field evaluation centers. This first meeting is a seminar covering the rationale and structure of industrial technology as a body of knowledge and a brief overview of the two courses, The World of Construction and The World of Manufacturing. The teachers are given written materials to study prior to the summer teacher preparation program.

In each field evaluation center, one construction teacher and one manufacturing teacher are selected to serve as head teachers. These individuals along with the field center directors spend eight weeks in Columbus working as full-time IACP staff members. During the first six weeks of this time, they become deeply involved in instructional materials development and begin to detail the two-week program for the preparation of the other teachers.

All of the field staff members, including field center directors and teachers, participate in the two-week teacher preparation program. The summer program allows field staff members to discuss the rationale and structure with headquarters staff members, read, review and discuss course strategies and content, watch demonstrations of and practice technical and methodological skills required to teach the course (masonry, concrete work and role playing, for example), discuss expectations for and techniques to be used in the evaluation program, simulate a routine week, and discuss the handling of administrative details.

After the teachers return to their schools and begin the school year, the field center directors take the principal responsibility for assisting the teachers in becoming more competent in teaching the IACP courses. Their efforts are supplemented by periodic visits to the field evaluation centers by headquarters personnel. During these visits, problems are discussed, the teachers are assisted with scheduling, and new materials are presented. One visit is scheduled just prior to the beginning of the second semester of school. The teachers are relieved of their teaching assignments for one day, and a mid-year teacher preparation program is conducted. This program consists of a methodical, detailed coverage of the course materials for the second semester.

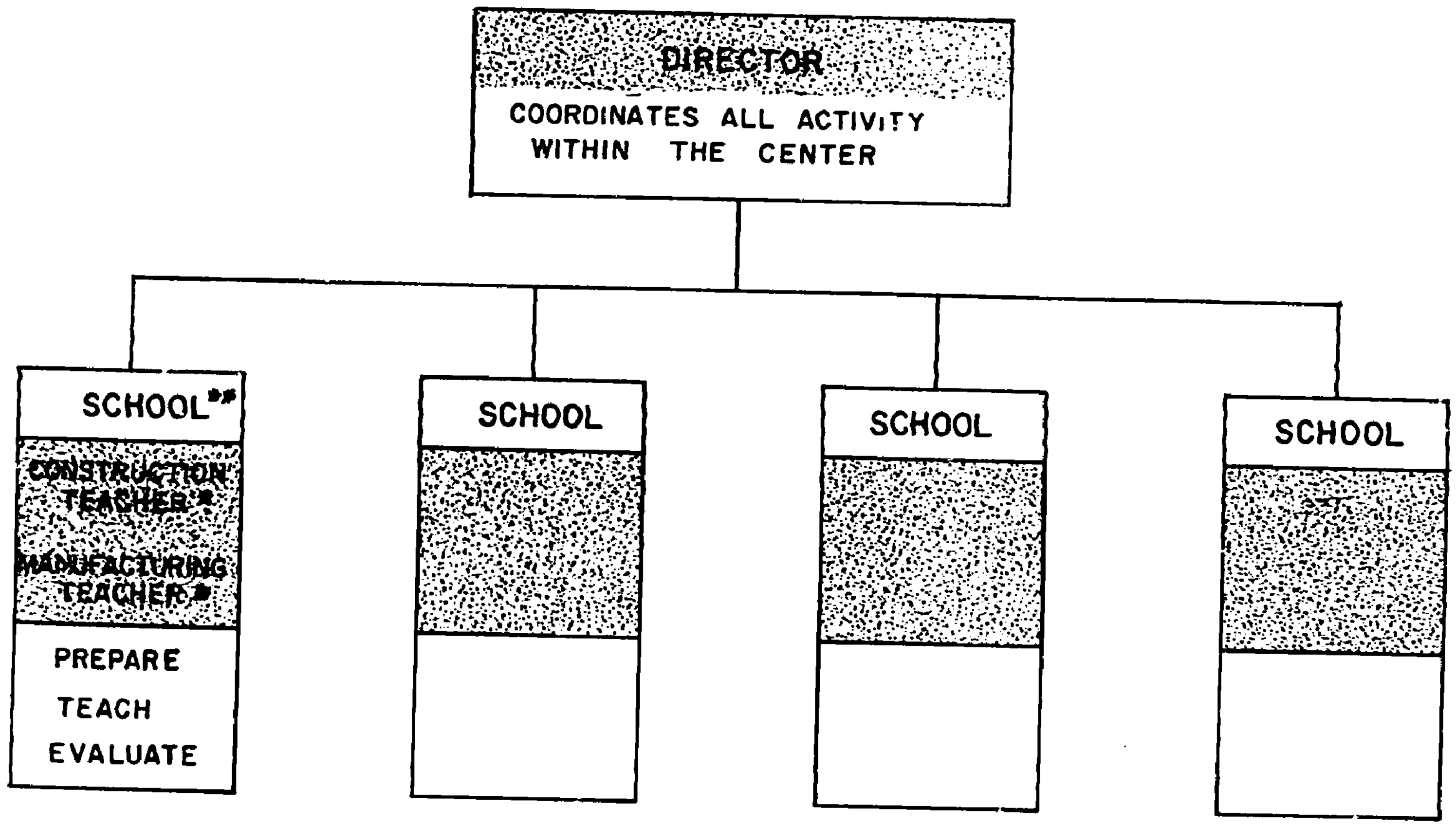
The head teachers and field center directors will serve as IACP staff members each summer during the entire field testing program. Other selected teachers may be asked to return as consultants for the summer teacher preparation programs in subsequent years of field testing.

The first twelve IACP teachers were prepared in the manner detailed above and the feedback system is in operation.

Dr. Blum is Assistant Professor of Education, The Ohio State University, Columbus, Ohio.

FIGURE I

ORGANIZATION OF A FIELD EVALUATION CENTER



* HEAD TEACHERS — HANDLE ALL FEEDBACK WITHIN THE CENTER

** SCHOOLS ARE WITHIN A 50 MILE RADIUS

FIGURE 2

FIELD EVALUATION CENTERS

1967-68

1968-69

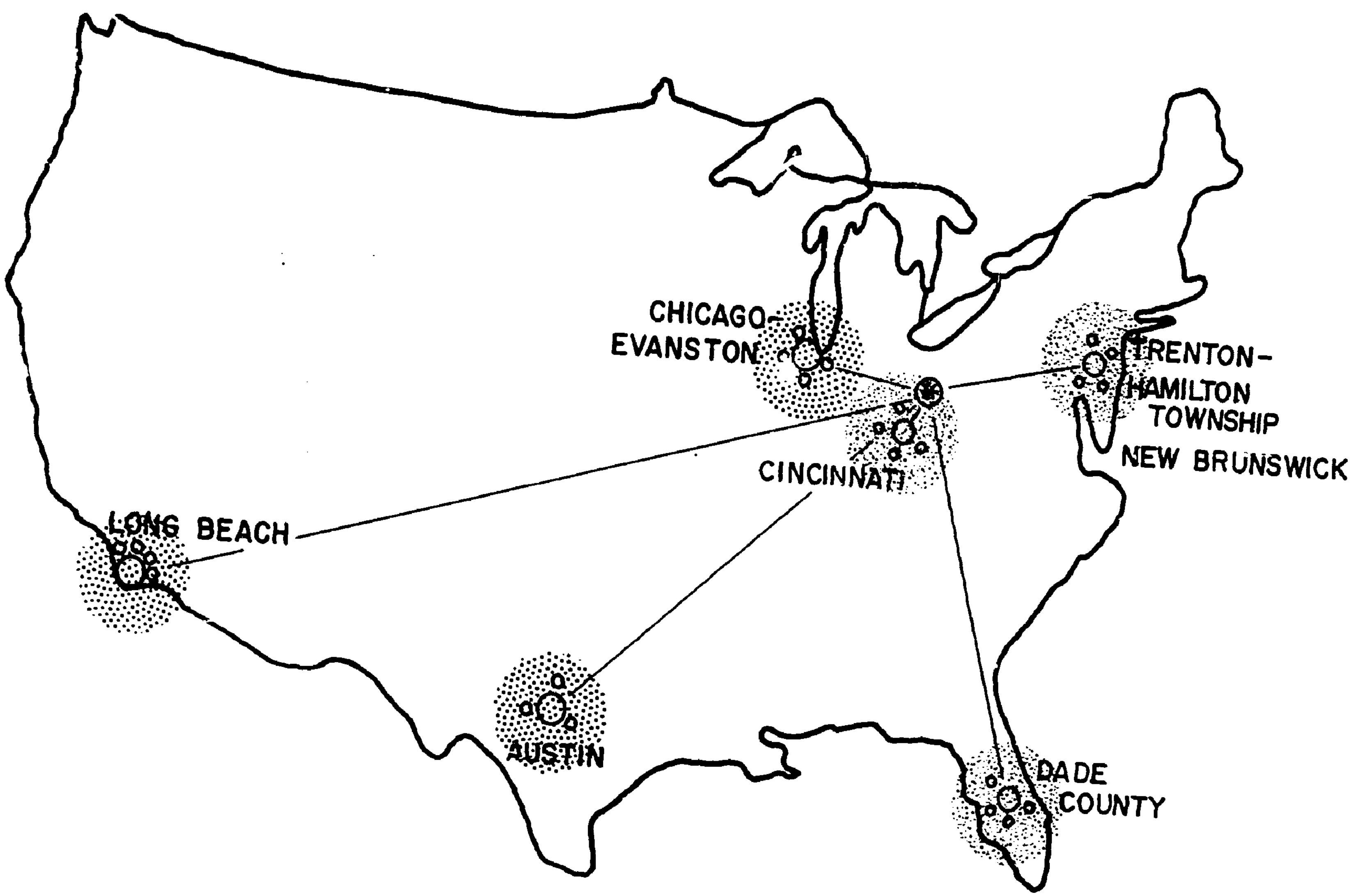


FIGURE 3

FEEDBACK FLOW

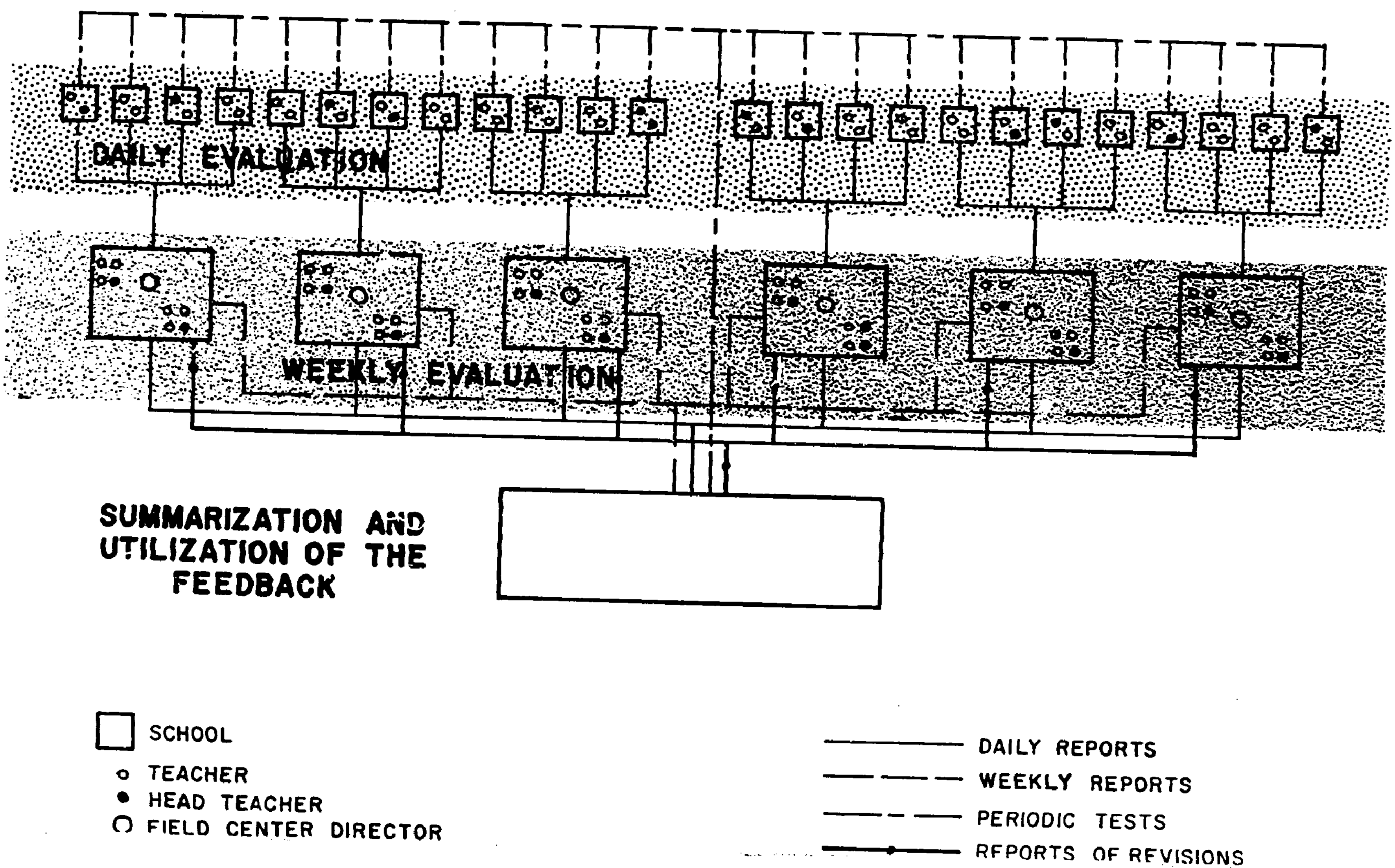
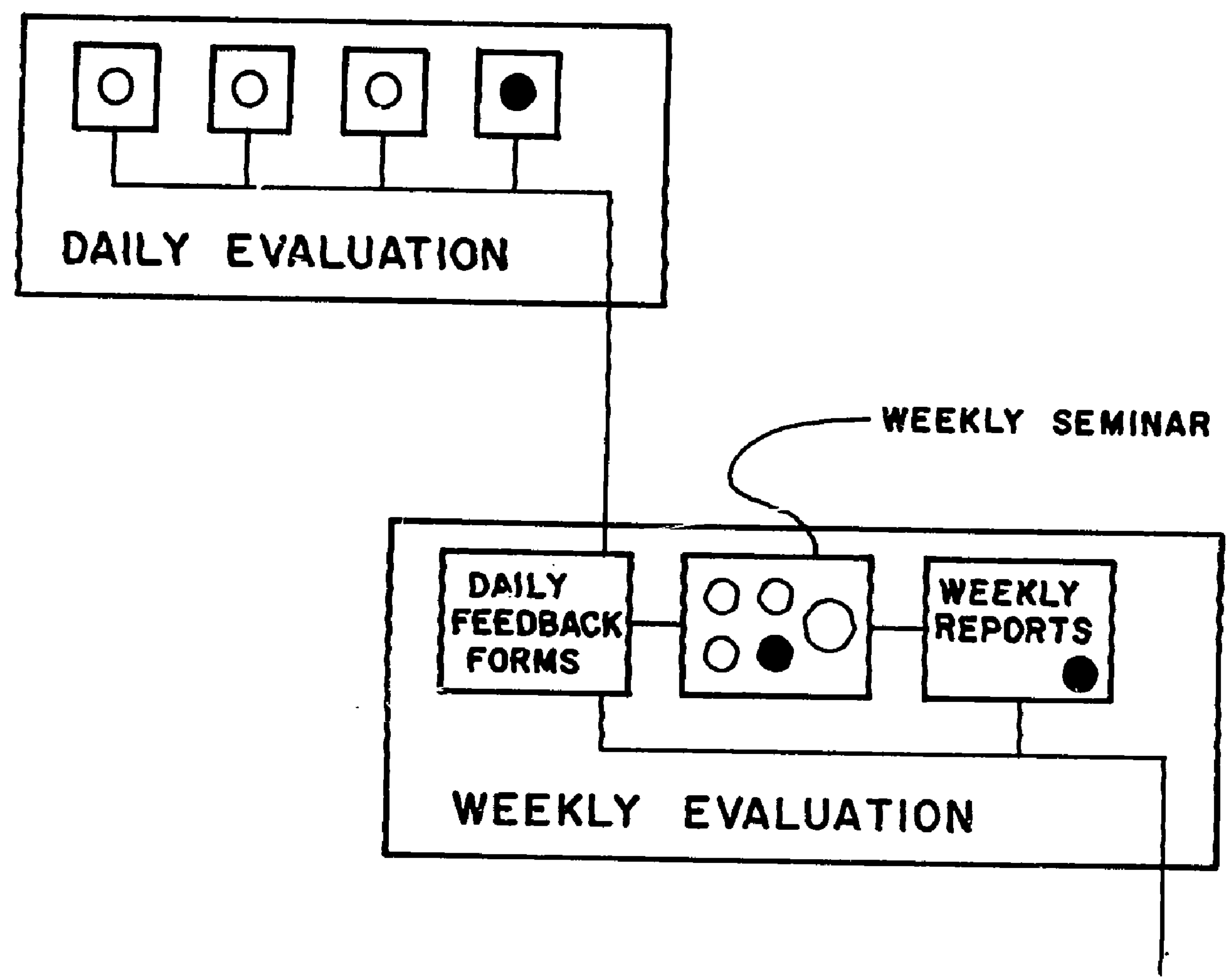


FIGURE 4

DEVELOPMENT AND FLOW OF FEEDBACK WITHIN A FIELD EVALUATION CENTER



REVISING THE I.A.C.P. TEACHING-LEARNING SYSTEM

James J. Buffer, Jr.

Introduction

A new instructional system is being developed, field tested and revised by the Industrial Arts Curriculum Project. Most revisions of the instructional materials are a result of the collection and analysis of feedback provided by pedagogists and substantive specialists. The information gleaned from teachers, students, field center directors and pedagogists is used to improve the efficacy of the teaching-learning processes. Substantive specialists evaluate instructional materials and prepare recommendations to improve completeness and validity of content. This feedback is analyzed by IACP evaluation staff and curriculum material specialists; recommendations are made for producing new guidelines for the development and organization of the instructional program. (See Figure 1 for an operational model of revision practices.)

Revising Teaching-Learning Processes

Evaluation and revision of teaching-learning processes depend primarily upon the following sources of feedback:

(1) teacher data reflecting reactions and recommendations to all aspects of the program, such as:
  - (a) appropriateness of time allocations, including time for teacher preparation and evaluation.
  - (b) students' interest in concepts studied.
  - (c) ability of students to participate satisfactorily in program requirements.
  - (d) pupil growth – cognitive, affective and psychomotor.
  - (e) organizational and operational problems for teachers and the school.
  - (f) omissions, inaccuracies and irrelevancies.
  - (g) general program acceptance by colleagues, industrialists and the community.

(2) student data reflecting their level of interest, success and involvement.

(3) achievement test data that measure if the behavioral objectives were met.

(4) supervisory feedback from field center directors, supervisors, head teachers, administrators and project staff members who work closely with teachers and observe the use of instructional materials and procedures; and

(5) data from the pilot program (used primarily for initial revisions of materials).

Feedback consists mostly of written evaluations (some oral) made by the teachers concerning instructional materials and laboratory experiences. These comments, based upon the teachers' experiences in teaching each of the instructional units, are placed on special feedback forms and directly onto copies of actual instructional materials. They are then taken to weekly evaluation meetings conducted by the head teacher and director of the Field Evaluation Center. Typical teacher feedback follows:

"Students needed more time to complete this laboratory exercise than was provided for in the unit."

"Small students were unable to thread the pipe because of lack of strength."

"A demonstration is necessary to clarify the activity planned for Day 54."

Typical student comments are:

"I couldn't understand what the textbook meant about primary and secondary goals."

"Our group didn't have enough time to lay all the brick and then clean up in the same class period."

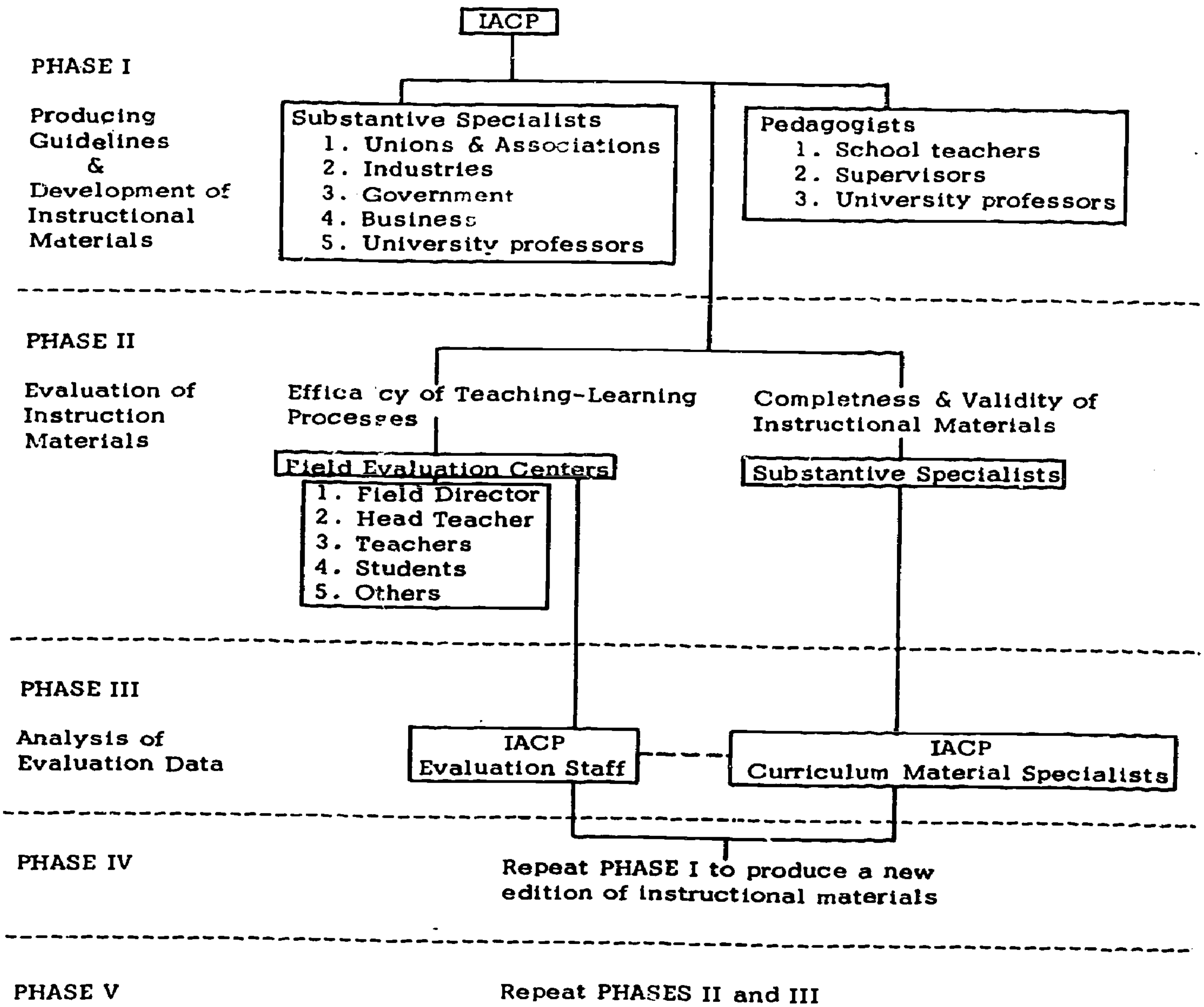
Feedback on daily lessons is mailed to IACP after each weekly regional meeting. Group recommendations of alternatives and solutions of common problems studied during the weekly meeting are included with the teachers' daily evaluations.

When all feedback for a given period has been received by the IACP evaluation staff, feedback material is categorized into instructional days and into each of the four types of instructional units – textbook, workbook, laboratory manual and teacher's guide. The data are then summarized and tabulated on specially prepared forms, and a composite of recommendations is prepared.

The following recommendations are representative of those prepared by the IACP evaluation staff:

FIGURE 1

MODEL FOR THE REVISION OF INSTRUCTIONAL MATERIALS



(1) Plan units of 35 to 40 minutes, allowing 5-10 minutes for discussion.
(2) Add cartoon characters for student appeal to emphasize and illustrate important ideas.
(3) Standardize workbook and laboratory questions to two or three item types, e.g., completion, multiple choice, matching.
(4) Prepare appropriate text editions for different ability levels.

Student feedback forms were used during the initial parts of our evaluation program to solicit students' opinions regarding their interest, suitability, readability and organization of instructional materials and activities. This practice has been partially discontinued because of the questionable validity and usefulness of student responses.

Additional feedback information is received from the results of achievement tests administered approximately every three weeks to all students. Computer-analyzed data from these tests are useful in determining if program objectives were met, for revising the instructional materials and the testing instruments, and for evaluation of students. When all answer sheets are returned, they are taken to the University Test Development Center for scoring and analysis. The results of the achievement tests provide additional

information as to student success in understanding and applying the concepts studied in course work. In order for test data to be of value when revising curriculum materials, validity and reliability of test instruments must be acceptable. Therefore, test questions in achievement and comprehensive tests are analyzed and revised, using the following information:

(1) statistical data received from the Test Development Center, and
(2) recommendations from field center teachers and directors and IACP test review staff.

Further revisions of test items have become necessary because of revisions in the instructional system.

When all feedback and test data have been collected and summarized, they must be further studied by the evaluation staff to determine what revisions will be necessary. Some revisions which affect future instruction must be immediately disseminated to assist teachers in modifying the present program. Other recommendations are stored for future revisions.

Revising Subject Matter

Subject matter is revised in a somewhat different manner than the teaching-learning system. However, methods of collecting and summarizing feedback for subject matter are similar to those used for teaching-learning methods. Suggestions from the students, teachers and supervisors are helpful in determining which instructional materials need more explanation and which materials are more interesting and feasible for students. However, the actual writing or revision of subject matter is generally done by experts and special consultants from business, industry, labor unions and associations, government and universities.

The involvement of content specialists begins with review and discussion of course outline and reading assignment topics. These individuals are asked to make judgments about the relative importance of various topics and the amount of time to be devoted to each. They are asked to consider completeness of outline and to suggest additions or deletions to the list of topics. This procedure provides a check on the completeness and accuracy of information to insure that it is representative of existing technological practices.

Summary

Using feedback suggestions from pedagogists and substantive specialists, the IACP staff evaluates subject matter and organization of instructional materials and writes guidelines or specifications for further development of the instructional system. These specifications are sent to specialists in the field who revise actual content and return the material to IACP to be reviewed, revised and organized for adaptation in the IACP program.

After the subject-matter and the teaching-learning processes have been revised, the instructional material follows the same sequence of development necessary in the initial printing.

Dr. Buffer is Dissemination Specialist at Ohio State University, Columbus.

DEVELOPING I.A.C.P. TEACHING-LEARNING EXPERIENCES AND MATERIALS

A. Dean Hauenstein

This briefing will present the designing of the instructional system, the engineering of teaching-learning experiences, and the production system used to process the teaching-learning materials for the curriculum "package". Both courses, "The World of Construction" and "The World of Manufacturing", have an introduction to technology (2 weeks), an analysis of management practices (9 weeks), an analysis of production practices (15 weeks), an analysis of personnel practices integrated within management and production, and synthesis units totaling 10 weeks.

Designing the instructional system. Of primary importance to the formulation of

methods for any instruction are the questions of "what to teach, how to teach it, and how do you know when you've taught it?" "What to teach" has been determined by the IACP rationale and structure. This section will be concerned with "how to teach it", and the third question will be examined in the following section.

To facilitate implementation of either of the above courses, a standardized instructional framework was developed. This was created from data from research of: learning theory, teaching methods, developing behavioral objectives, evaluation techniques and communication techniques. The instructional system requires a built-in means of collecting and measuring the cognitive, affective and psycho-motor changes in behavior or learning achievement every day. As a result of studying various alternatives, the following plan was adopted.

Prior to class the student should be exposed to the initial concepts via 15-20 minutes of reading in a textbook. The textbook will present the broad continuum of a particular concept. A companion workbook will reinforce the major points of the reading in a semi-programmed manner and help the student to apply his knowledge to the solving of simple problems within a 10-15 minute period. In providing practical evidence of the particular concept, the workbook prepares the student for class.

In class, the teacher briefly reviews the previous day's learning and relates it to the present assignment. The teacher then presents the major concept of the present lesson and relates, clarifies or demonstrates its application to local situations which should be familiar to the students. This helps to transfer and reinforce the learning. The presentation is followed by a teacher-led discussion in which the student is stimulated to respond to pertinent questions which are aimed at accomplishing the behavioral objectives. Their responses in the discussion provide evidence of the cognitive and affective dimensions of learning. The discussion period is followed by a laboratory activity in which the student is given opportunity to apply his knowledge to carrying out efficiently an activity comparable to some aspect of the textbook presentation. That is, he uses his knowledge to perform rationally. The activity provides a way to check how well the behavioral objectives have been met, as well as evidence of cognitive, affective and psycho-motor achievement. At the end of each school day the teacher should evaluate the experiences and recommend the changes necessary to the improving of the teaching-learning situations.

Engineering teaching-learning experiences. With a body of knowledge, course objectives and an instructional system, the curriculum can be engineered for every day of the school year. Engineering involves calculating the input of written and oral information, behavioral objectives and activities to bring about the desired daily change of behavior and its cumulative effect.

The first step was to dissect the large course units into daily lessons and then outline the information input for each one. In effect, the thinking one goes through in making priority decisions is "if you had but one day to teach industrial technology, what learning is worth most?" If you had two days? If you had twenty days? If you had one hundred eighty-five days? The result is a hierarchy of concepts which can then be outlined into their elements.

Once the textbook outline has been developed, the behavioral objectives for the workbook, discussion and laboratory activity can be developed, and the questions, problems and activities can be created. To create activities that can be utilized by any school in the nation, ideas must be sifted through a "feasibility screen". This screen is made up of such factors as: their cost, their time, whether or not they are illustrative of the employed concepts, whether or not they will aid in developing the behavioral objectives, whether or not they are commensurate with student and teacher ability, how much special equipment they would require, what teaching procedures would be necessary, prediction of student interest, how the class must be organized, how many students would be involved and the average size of the laboratories, to name a few. The teachers' lectures, reviews, questions, teaching procedures and demonstrations, including the visual aids and equipment, must also be designed to balance the other material so that it all contributes to the desired behavioral outcome.

The instructional system, composed of the behavioral objectives and their implementation through purposefully designed teaching-learning experiences in the textbook, workbook, classroom and laboratory manual, helps determine what one has taught and what the student has learned. The stud nt has been exposed to situations which should elicit the desired behavior. Thus, the teacher knows what to look for, and can see what and when it has been learned.

The production system. The production of teaching-learning materials is the process of developing some eight hundred individual, but standardized, components. They are assembled into the textbook, workbook, laboratory manual, teacher's guide, tests and other auxiliary aids. The processing of software (all written materials) entails critical quality control of: the technical accuracy of the content, rewriting to the appropriate grade level, the grammar, the illustrations, their captions, the cross-references, the listings, the headings, for consistency and other standards of format. All hardware (special equipment, visual aids and constructed or manufactured products in the laboratory) must be efficiently designed, engineered and tested to be workable, of minimum cost, must require minimum storage space, must be salvageable whenever possible, and must be representative of industrial practice.

A production control chart is used to identify each developmental step and to control each stage of the processing of the approximately eight hundred components. To maintain maximum production with minimum personnel, the package for each course is produced in two sets of volumes. While the second set of volumes (2nd semester materials) is being field-tested, the first set of volumes (1st semester materials) is being evaluated and revised. This staggered but continuous system will be repeated for three years before the package is finally approved for public adoption.

The following is a list of steps for the processing of the software and hardware components. Software: (1) outline required written material, (2) assign an author, (3) receive his manuscript and put it into a first typing, (4) criticize and edit the material, (5) rewrite to appropriate reading level, (6) do a second typing and technical editing, (7) do a third typing and proof-reading, (8) do the illustrating and the caption-writing. At this point the identified teaching-learning hardware is developed. The software is held until the hardware prototypes are developed and the activity with hardware is photographed for insertion into the software.

Hardware: (1) identify the hardware, (2) design and engineer the hardware, (3) criticize the design, (4) procure resources, (5) produce prototype, (6) try out the prototype and revise, (7) photograph the hardware, (8) reproduce in quantity, (9) package, (10) distribute.

Software: (9) paginate and paste-up photo copy, (10) correct photo copy, (11) compile photo copy into volumes, (12) print it, (13) bind it, package it and (14) distribute it.

Dr. Havenstein is a Curriculum Specialist in Columbus, Ohio.

F-14.1.6 AIAA
Forum of Innovations
INDUSTRIAL ARTS POWER MECHANICS AND SCIENCE: PHASE ONE OF AN INTER-RELATED CURRICULUM
Chm., Fred A., Baer; Rec., Norman Bang; Speakers, Robert L. Woodward, Ralph C. Bohn, Jack E. Reynolds, David O. Taxis; Host, Donald N. Hanson.

NDEA AND POWER MECHANICS-SCIENCE CURRICULUM DEVELOPMENT

Robert L. Woodward

The publications Mathematics and Industrial Arts Education (1960) and Industrial Arts and Science (1962) were prepared and published by the California State Department of Education under National Defense Education Act grants. The purposes of these publications were to identify the mathematical and scientific principles applied in industrial arts and to provide instructional units that could be used in industrial arts programs.

It was never the intention that industrial arts should assume the responsibility for teaching mathematics and science per se; but rather, to reinforce and augment the instruction in these subject fields.

Because of changes taking place in education, it is found that the independent reinforcing of other subject fields through industrial arts instruction is not enough. What is needed is instruction that provides meaningful interrelationships of subject fields; a team approach where each subject field interrelates and reinforces. This team is composed of specialists in English, industrial arts, mathematics and science. Unlike certain other interdisciplinary approaches, each member of this team instructs, motivates and retains the identity in his subject field and, at the same time, interrelates his instruction with the other subject fields represented on the team.

In order to develop instructional material that would provide a foundation for this interrelated approach, the area of power mechanics was selected. The area of power mechanics is rich in mathematics and science content, industrial arts content and application, and, of course, requires English for instruction in and between the subject fields.

Under National Defense Education Act grants, phase one, which is the development of this instructional material, is nearing completion. In December of 1966, teacher educator-specialists in power/automotive mechanics from the ten California colleges with accredited industrial arts departments, as well as industrial arts teachers and supervisors, participated in an industrial arts power mechanics-science workshop at Fresno State College. The participants in this workshop prepared instructional units covering natural, steam, mechanical, explosive, electrical, hydraulic, pneumatic, solar and thermal power. In December of 1967, an editorial committee composed of specialists in science and specialists in industrial arts corrected and augmented the instructional units prepared at the 1966 workshop.

During September of this year (1968), an experimental edition of these instructional units, titled "Industrial Arts Power Mechanics: Applying Scientific Principles Relating to Power-Energy-Force", will be distributed to all power/automotive mechanics teachers in the high schools of California. These teachers will be asked to review the material and complete a questionnaire which will request information concerning suggested changes, corrections and additions. Following this review, the publication will be printed in final form and will be available in January of 1969.

A future phase of this project will be to have teachers of English, industrial arts power mechanics, mathematics and science participate in a curriculum workshop where existing courses of study will be changed and augmented to bring about this team-approach interrelationship of subject fields.

Dr. Woodward is Industrial Education Consultant to the California State Department of Education, Sacramento.

INSTRUCTIONAL UNITS UNRELATED TO THE INTERNAL COMBUSTION ENGINE

Jack E. Reynolds

The study of power mechanics and the application of various forms of power to produce work is a concept that is growing in popularity in many industrial arts programs of the nation. To many, the study of power mechanics simply means the application of the small gasoline engine as a source of power or automotive mechanics per se. In actuality, instruction in power mechanics encompasses a very wide range of study in mechanics, mathematics and scientific principles.

The instructional units that have been developed by committees in industrial arts power mechanics in California include the application of power from the natural animal energy found on the earth to some of the most recent applications of jet and nuclear power. The units of instruction are planned for use in industrial arts laboratories where all students can benefit from the study of power, energy and force as it takes its place in the technology of today.

Students in modern junior high schools, many of whom are urban-oriented, need insight into the uses and application of animal energy, muscle power as furnished by animals and humans. It is apparent in many of our urban centers that students have not experienced the rigors of power application as supplied by animals or humans.

Likewise, many of today's students have never been introduced to the application of mechanical power or mechanical advantage as produced in simple machines. Students should have experiences with power application through the use of levers, wheels and axles, inclined planes, wedges, pulleys and other simple and compound machines.

In recent years the potential of high explosive power has been applied as an aid to many occupations to assist the workman in doing his job. An example of this type of power is the power-actuated tool now in use in industry. Another modern example of power application is high-energy forming materials. In the area of explosive power, an understanding of jet and rocket engines is most important.

In the modern technological world, students must gain knowledge of electricity and its ability to do work. Units of instruction are provided on the battery. The dry cell, which contributes to the many activities found in modern living, is explained as a chemical source of electric power. Students must also gain knowledge about the transmission of electric power. Units are provided to gain an understanding of electromotive force (EMF) along with an understanding of conductors and insulators. Principles of measurement of electrical energy are presented through units in the study on voltage, current, resistance and Ohm's Law. Introductions are provided to the performance and the operation of transformers, electrical motors and power cells, as well as the modern use of semi-conductors.

The modern approaches to power mechanics must include the application of hydraulic and pneumatic power in the array of modern technical power applications. Control and transmission of power through hydraulic and pneumatic devices are demonstrated in units of work involving jacks, presses, machine tool controls, air-powered tools, spray guns and others.

Recent applications of power involving solar and thermal units are most important to students. Units of instruction involving the nature of heat as applied in heat collectors and the desalting of sea water are examples of solar power. Thermal power is included with units in welding theory as applied to molecular structure and kinetic energy.

The instructional units prepared by committees in California under the direction of the California State Department of Education form an outstanding guide to laboratory activities which, it is hoped, will assist students in acquiring knowledge about power applications that will serve them throughout life.

Mr. Reynolds is Program Specialist with the Curriculum Development Center, Sacramento, California.

THE BROAD AREA OF INDUSTRIAL ARTS POWER MECHANICS

Ralph C. Bohn

Power mechanics means different things to different people. To some, it is simply renaming the automotive program without changing the content. To others, it identifies a small engine program. The best of these relate the small engine to the total grouping of heat engines as a major source of power. To still others, it is all sources of power which serve as the prime movers of industry and modern society.

To another group, power mechanics includes the total study of power as it relates to home and industry. This concept includes power sources, transmission and use. In its broadest aspect, it can be so all-inclusive that it includes all phases of the study of industry. In a more restricted sense, it is limited to the generation and conversion of energy to power, and to the transmission, control and use of this power. It is this concept of power mechanics which is gradually evolving within the profession, and which fills a void within current industrial arts offerings.

Within this definition, power mechanics includes the study of:

(a) Development of power for industrial and home use.
(b) Control and measurement of power.
(c) Transmission of power through mechanical, fluid and electrical means.
(d) Use of power to accomplish work.

Power is developed from any of the sources of energy available to man: mechanical

(motion), nuclear, heat, light, chemical and electrical. Of these, most of the energy used to power industry is derived from chemical sources – the burning of fossil fuels. Nuclear energy is rapidly increasing as a source of electricity but is still quite insignificant. Mechanical, in the form of harnessing falling water to generate electricity, is an important source of power. A quick analysis reveals that most of the energy we put to work for us is in the form of motion from heat engines, or in the form of electricity (generated from turbines run by falling water or heat engines). The study of these units is (and has been) an important phase of power mechanics.

The concept of control – or its emphasis – appears relatively new to power mechanics. Yet, it is at the foundation of all power available for use. The energy around us is almost unlimited. However, the control of most of this energy is still beyond man's capability. Our rate of progress as a civilization is directly related to the rate at which we have been able to control energy to provide usable power. Control, then, becomes a key concept in the study of power mechanics.

Control is important in the generation of power. Power is needed in predetermined amounts and in predetermined places. Once power is generated, it must be used. Storage is limited to batteries and a few exotic methods. None provide for the storage of large amounts of power. As a result, generation must be carefully controlled.

Control is the most important phase of power transmission – whether it be mechanical, fluid or electrical transmission. It is through careful control that we obtain the tremendous mechanical advantages available through hydraulics and pneumatics.

The broad concept of power mechanics must include the study of the sources, transmission and use of power in home and industry. Control of power is an integral part of this total program, and deserves special consideration as power mechanics programs are planned or revised.

Dr. Bohn is President of AIAA.

F-14.1.8 AIAA
Forum of Innovations
BEYOND THEORY—CLASSROOM APPLICATIONS OF AMERICAN INDUSTRY
Chm., Neal Miller; Rec., Alvin Weitkamp; Speakers, Darrel Ebert, Roger Imhoff, John Debrauske, Richard Gebhart, David Roffers; Hosts, Raymond D. Johnson, Michael Sucharski.

ASPECTS OF RESEARCH

Roger B. Imhoff

It is the belief of the American Industry Project and the participating teachers that student involvement is the key to developing successful student understanding. For this reason, activity is a key word in the structure of the American Industry course of study.

These activities can be used to enhance two or three concept areas or all of them, depending upon the objectives of the teacher.

The purpose of the activity, "Toys for Tots". was one such activity. It was used to give the students some practical experience in the conceptual areas of communications, research and management.

Our attention was first set on the research aspects of this activity. Research was first identified to the students as being: "A systematic and unbiased investigation of a problem to discover facts or principles about the problem."

Also discussed was that before research can take place, there must be a definite need for it. At this particular time there was a need, and this was in the form of a product that we could use to enhance the concept areas of research, communications and management.

At this point, the "scientific method" was explained to the students. From their understanding of the scientific method, the students came up with a procedure to be followed in carrying out research. Their procedure is as follows:

(1) There must be a need for research.
(2) The need must be defined as a specific problem for research.
(3) There must be a listing of possible or tentative solutions to the problem.
(4) Each solution or hypothesis has to be given a fair chance to succeed by either testing or experimentation.
(5) Each possible solution or hypothesis to a problem has to be given a fair evaluation before the best one is selected.

To make the scientific method something other than factual knowledge, an activity of some sort was needed to put it on a practical and more meaningful level. We decided that a product-type activity would fulfill this need very well.

The students were given a choice of producing a product to sell to the student body for an expected profit, to give to their parents at Christmas, or to give to underprivileged children at Christmas. The students chose the third option.

We decided that our first step was to perform a market research in the form of a survey to find if there was a need for a product of this nature. In this survey, they hoped to get the answer to two questions:

(1) If there was a need, what quantity is needed?
(2) Toward what age level do we work?

Their survey answered both questions. They found that the pre-school-aged child would be the best because he would require simplicity. The quantity needed was a different matter. They found that the number of these children was far too great and we could not expect to fulfill the total need. It was then suggested that we first determine what type of toy we were going to produce and determine what the production cost would be for each before selecting a quantity to be produced. We knew how much money we had available, and this would in the end determine quantity.

After the need was determined and the age level decided upon, the choice of what to produce had to be made. The general feeling of the class was that this product should be a toy.

We then went back to the second point of the student-developed procedure of the scientific method, which was that "the need must be defined as a specific problem for research."

At this time we came up with a problem statement which was as follows: "What toy can we produce for underprivileged children of a pre-school age at Christmas time?"

We then went to point three of the student research procedure: The listing of possible or tentative solutions to the problem. Several solutions of hypotheses were then listed. Do young children prefer: building blocks, a peg rack and hammer, a rocking horse or a yoyo?

Point number four of the research procedure was then brought into discussion. This stated that: "Each hypothesis or possible solution to the problem had to be given a fair chance to succeed by either testing or experimentation."

It was immediately suggested by students that we get a group of underprivileged children together and carry out an experiment with the listed hypotheses. It was then pointed out that if experimentation was to take place, they had better have some objectives which they hoped to fulfill through this experiment.

After considerable discussion and exchange of ideas the consensus was that there was really only one true criterion, that being to find which of the toys identified in the selected hypotheses create the greatest interest. The boys felt that interest could be measured in two areas: time spent with each toy and the amount of creativity allowed by each toy.

Before the experiment could begin we ran into another problem. A few of the boys questioned our decision as to the participants of our experiment. They wondered where we were going to find underprivileged children for the experiment. The question was, is it important that we use underprivileged children for the experiment? They felt that enough research had already been done by producers of toys to prove that all children of normal interest and abilities enjoy playing with toys.

The class agreed, so we decided to select boys from our class with younger brothers or sisters in this age grouping. With the objectives of the experiment in mind, these students were given the weekend to experiment with the selected hypotheses, after which they made their reports on the experiment.

They presented information as to the lengths of time each child in the experiment played with the suggested hypotheses.

After the reports we went back to point five of the student-selected research proce-

dure: "Each possible solution or hypothesis has to be given a fair evaluation before the best one is selected."

We studied the time charts constructed by the boys. We also discussed some of the other points brought out by Tom and Dave in their experiment. One of these points was the coordination factor brought out by Tom. From this the class could see that many other factors were involved in the problem as well.

From the evidence presented by Tom and Dave, building blocks were selected as the product to be used by our class to fulfill the problem statement.

From here a line organization chart was made up and selection of personnel was made to fill the different managerial positions. At this time our lessons on management were covered and the responsibilities of the different managerial divisions were discussed.

Within our managerial set-up, there was a division of responsibility for product development. Research was again needed to determine the shape, size and number of blocks per set; type of wood to be used; type of paint to be used and its application; and method of packaging.

The decision as to the number of blocks per set and the shapes and sizes of these blocks was based on a survey, made by the product development department, of commercially made sets. They stated that substantial research had already been done in this area by manufacturers of toys and that there was little they could add to this existing information.

The engineering department was then given orders to complete the necessary drawings and bills of material.

The product development department then focused its attention on the type of paint and its application. Two methods of painting were suggested. These included spray-painting and dipping. Through experimentation, spraying was selected as the method to be used because of expedience in application and quickness in drying.

Through an examination of properties of paints, they discovered that they would have to use a non-toxic paint. Their reasoning for this was its lead-free quality, which is important to the safety of children.

Color selection was based on a survey made by the product development department. Their survey included stores selling toys and toys owned by younger brothers and sisters. They concluded from their survey that most toys for use by younger children are painted with very bright colors, such as red, yellow, blue, orange, green. They decided that these should be the colors used on the blocks.

Upon the decision of the product development department as to paint type and colors, the procurement manager was delegated to prepare purchase orders for the paint and wood needed to facilitate production. Finding a source for non-toxic paint in a spray can of economical size proved to be quite a problem, but after much communication with local suppliers and a little time, the order was filled.

The packaging of the blocks brought about quite a diversification of ideas. After a lot of conversation and confusion, I had to remind the students of research procedures. We then decided that the best way to solve the problem was to go back to and follow the procedure we had earlier set up. A problem statement was made, several hypotheses were given and tested by experimentation and a decision was made.

Their choice was a mesh potato sack as the container to be used for packaging the blocks. Their decision was based on accessibility of the bags, flexibility as containers, and simplicity of preparation. All they had to do was turn them inside out and they were ready for use. And, they kept the sets of blocks together and made it easy to transport them.

At the completion of production, fifty sets of building blocks, each containing ten different shapes painted with five bright non-toxic colors, were completed. These sets were then given to three local charitable organizations for distribution to underprivileged children at Christmastime.

After the completion of the activity, it was evaluated by myself and the students as to whether it met the objectives for which it was intended. These objectives were: to reinforce the concept areas of communications, research and management. The student evaluation was in the form of a written report. They were to relate the activity itself to the subject matter discussed in the three concept areas. Most reports were favorable, many were good, and a few were exceptional. But as in any research activity, regardless of how many surveys are taken, how much documentary information is located, and how successful the experiments are, the results are never one hundred percent accurate. Rather, the results provide the basis for further research and better solutions.

Mr. Imhoff teaches American Industry in Manitowoc, Wisconsin.

AMERICAN INDUSTRY INSTRUCTIONAL MATERIALS

Richard H. Gebhart

The dual task of constructing a conceptual framework of industry in the United States and developing a completely new secondary curriculum based upon that framework might be described as a monumental undertaking. The challenges implicit in this undertaking have been accepted by the American Industry Project, and course materials for our secondary schools have been developed. The intention of this presentation is to describe the events that took place in preparing the rationale and course materials.

The Project started with the premise that students need to study American industry and that the conceptual approach can be effectively employed. With this in mind, let's consider the two broad objectives that serve as the basis of our work: (A) To develop an understanding of those concepts which directly apply to industry; and (B) to develop the ability to solve problems related to industry.

Another basic tool in the development of the American Industry materials is our definition of industry. It has been defined as "an institution in our society which, intending to make a monetary profit, applies knowledge and utilizes human and natural resources to produce goods or services to meet the needs of man." Along with the definition, the knowledges (concepts) necessary to understand American industry had to be identified. There are thirteen concepts that apply directly to American industry. They are communication, transportation, finance, property, research, procurement, relationships, marketing, management, production, materials, processes and energy. Five concepts that represent the environment of American industry have also been identified. They include government, private property, resources, competition and public interest. The conceptual structure would not be complete without the identification of and definitions for the major concepts shown above. Therefore, models depicting the sub-concepts of each major area were structured. It should be pointed out that although a study of the concepts is important, equally important are the interrelationships of these concepts.

The American Industry Project has acquired information used in structuring its concept areas from a variety of sources. An extensive review of literature, followed by consulting with a few educators and industrialists, provided the basis for the first models and definitions. The next step included nationwide consultant contacts which provided comprehensive consultant feedback information from educators and industrialists. Sample contacts include: Oscar Mayer Company, 3-M Company, North American Aviation, Carnation Company, United Auto Workers, California Institute of Technology, and the University of Chicago.

When the feedback information had been received and assembled, the American Industry Project staff systematically developed a conceptual model for each basic area of study.

With the conceptual models and definitions as a guide, the objectives for three American Industry courses were developed.

Level I, designed for eighth grade students, has the following course objectives:

(1) To develop a knowledge and understanding of the major concepts of industry and their relationships.

(2) To develop the ability to solve simple problems related to industry.

Level II, designed for tenth grade students, has two broad objectives also. They are:

(1) To develop in-depth understanding of the concepts of industry, and to develop refined understandings of the relationships among the concepts.

(2) To expand the ability to recognize and solve complex problems related to industry.

Level III, which is for twelfth grade students, is designed to develop knowledges and problem-solving skills within a concept area or cluster of concept areas appropriate to the individual's level of ability and interests.

With the works of Bloom (1965), Gagné (1965) and Mager (1962) serving as guides, taxonomically structured behavioral objectives for each course were then prepared. In conjunction with these objectives, course outlines also evolved. After this the instructor's guide, which contains lesson plans and student activity sheets, was written. Student texts were also written and provide information related to the units of instruction. Simultan-

eously, instructional media, including films, filmstrips, models, bulletin board displays, overhead transparencies, etc., were produced. In essence an American Industry instructional package has been developed and is being field tested for Level I, American Industry. Let me use the outline from Level I as an example:

Unit I	Industry Today	- Let's analyze industry.
Unit II	The Evolution of Industry	- The needs of man and why he progressed.
Unit III	Organizing an Enterprise	- Let's start a business.
Unit IV	Operating an Enterprise	- Let's produce using modern production methods.
Unit V	Distributing Products and Services	- Why does a product sell?
Unit VI	The Future of Industry	- Where do we go from here?
Unit VII	The Students' Business Venture	- The students organize, produce and sell.

In progressing through these units, the cyclical approach is used, which takes a student from his entry level to greater depths of understanding by becoming involved in simulated industrial activities. These activities not only inspire learning but also provide insight into the future.

In summary, the instructor's guide serves as the focal point for all course materials. It provides guidance for the teacher in identifying a consistent course pattern; it identifies supplemental reading for teacher and student; it provides suggested student activities; it combines suitable media with prescribed lessons; and it outlines evaluation items. By combining the instructor's guide, student texts and instructional media, one can envision the instructional package designed for teaching the concepts of American industry.

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BEYOND THEORY TO CLASSROOM APPLICATIONS

David W. Roffers

Finding meaningful curricula for junior high boys and girls (particularly 14- and 15-year-olds) of the inner-city school is no easy task. School systems throughout the entire United States are presently engaged in various experimentation to find some answers to an extremely trying question – what will work with and be meaningful to these kids?

My purpose in being here is to describe the Lincoln Learning Center's American Industry Program, which I feel has been most meaningful in providing some answers to the perplexing plight of the inner-city child.

A brief description of the Learning Center is in order.

The challenge was issued in January, 1965. Take forty-five 7th, 8th and 9th graders from North Minneapolis, potential dropouts who have not learned the basic skills and are not profiting from existing curricular offerings, provide them with a dedicated staff of four teachers, a director, a counselor, a part-time social worker, a clerk and a few teacher aides who are convinced that the students can learn; locate this combination on Plymouth Avenue in a storefront school, and then add to this package objective understanding and feeling.

This program, under the direction of Minneapolis Public Schools, has now been in operation for three years. To remove the veneer of disinterest expressed by these students at the Center, we have combined a use of new materials, different organization of the school day, many new and varied experiences provided in a non-school setting – and mixed it with lots of individual help and empathy. Of significance to me is that we have discovered that these students desperately want to learn – and at the Center for all concerned – learning "is the name of the game."

Needless to say, students at the Learning Center have many needs. Foremost of these, I believe, is self-pride. We at the Center are very much concerned that our students see, understand, accept and respect themselves. We feel that the American Industry Project has greatly contributed here. The self-pride demonstrated through individuals being able to set up their own companies, produce a product and derive the achievement and profits from their energies at the Learning Center is something to behold.

As visitors have entered the American Industry arena and have shown a slight interest in the boys' footstools or coasters, I am beginning to understand more fully how important pride is to our youngsters. When twenty boys come to me with gleams in their eyes flashing $70 from the sale of footstools, I know what result success has with our students. When the snowstorms and bitter cold hit Minneapolis these past two years and approximately one-third to one-half of the school population of Lincoln Junior High stayed home, I wasn't too surprised to see the majority of our boys in school. Their due date for twenty-five footstools was nearing and a "deadline is a deadline".

In order for any company to function smoothly there must be a real team effort. One characteristic of our students at the Learning Center is their inability to work as a team or as a class to accomplish any goals. Because of their various backgrounds and problems, they prefer to do most things individually, and most of our students accomplish best in an individual setting. Over the past two years this has changed during their time spent in American Industry. Boys and girls have learned to function as a team out of sheer necessity. I recall one day when the boys were studying the characteristics of mass production. To clarify the point their instructor, Mr. Ramberg, had set up tables in an assembly line fashion. The products: attractive fishing lures. Of course, the intricacies of assembling the entire product – the fishing hook, beads and the other necessary ingredients — required a great deal of dexterity and speed to be done economically. The first time through the assembly line. eight boys took fifteen minutes to produce the lure. The next time, down to twelve minutes, then to eight and finally, after several tries, the boys were able to complete their product in three and one-half minutes sharp. The pride in this team accomplishment and the learning that took place in the boys who are not supposed to learn was something to behold. They were motivated. They had a goal, and once you give our students a sensible goal, a goal meaningful to them, they are "ready to play ball".

An often-stressed need of our students is that of improvement of their basic skills. According to standardized tests, approximately 70% of the students at Lincoln Junior High School are two or more years below grade level in reading and mathematics skills. American Industry students must know communication techniques to do effective advertising and sales work. They must be able to study and to analyze current advertising techniques and effectively use these same tools to advertise their products. Therefore, our students know that they won't be successful in selling their products if they can't communicate them to the public, and they can't communicate if they can't handle their basic skills. With money or a grade on the line, the basic skills soon become a necessity. They learn them.

Many inner-city junior high school students, particularly 14- and 15-year-olds, need a sound background in occupational education if they are going to stay in school. A present concern among educators today is that we find ways to stimulate dropouts 16 years and above to come back to school. Perhaps this is the wrong approach. Perhaps we should be more concerned about 12-, 13-, 14- and 15-year-olds who are merely passing the time of day in classes now and who see no need or use in coming to school. The American Industry program at the Learning Center has given meaning to this inner-city junior high school student to stay in school. He sees that through coming he can accomplish some of his present and future goals which could not be accomplished through the current traditional program. For instance, they now can earn a little spending money, and actually like school. As one boy stated a few weeks ago, "Gee, something must be wrong with me. I never came to school before when I was sick, but I had to hand out paychecks – and those guys count on me."

The Lincoln Learning Center staff is looking forward to next year. We hope to expand our American Industry program, and with the help of industry, notably General Mills, Inc.,

add a new dimension to the current program.

According to present plans, students will form their own companies with the help and direction of both school and industry personnel to achieve understanding of the total operation of a company. It is hoped that in the development of ideas for products the educational experiences developed will implement the learning skills with a meaningful and direct reward. It is hoped that wages to employees (students enrolled in program) will be paid from earnings of the company.

Most of the students' time will be spent in the production of a product. However, some students will also be involved in the planning, managing and supervising of the company under the direction of school personnel and industry supervisors who will relate mathematics class activities to the financial problems that the business encounters, and the reading and communication activities to planning the product.

We at the Learning Center feel that this breakthrough with industry, where they will commit themselves on a large scale to a cooperative venture with the school system, could have tremendous significance for the future of inner-city education. We in the schools have a great deal to learn from industry, and perhaps they can benefit from their association with us.

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F-14.1.9 AIAA
Forum of Innovations
EDUCATION FOR A PRODUCTIVE SOCIETY—A SYSTEMS APPROACH
Chm., James E. Gallagher; Rec., R. Mondell Coger; Speakers, Milton Petruk, James Gallagher; Host, Clarence L. Heyel.

A SYSTEMS APPROACH FOR A PRODUCTIVE SOCIETY

James E. Gallagher
Milton Petruk
Darrel R. LeBlanc
Donald W. Manuel

The brief description of the industrial arts program at the University of Alberta, Edmonton, Alberta, which appears below is divided into four parts: (1) organization of phases one through four, (2) physical facilities and content organization, (3) teacher education program and (4) research in progress. The description here, supplemented with transparencies and slides during the program session, does little more than touch the surface of any one of the four topics.

(1) Organization of Phases One through Four

Phase One. The Phase 1 multiple-activity environment is designed to introduce grade seven boys and girls to, and develop an appreciation of, tools, machines, materials and processes. Awareness and appreciation are developed in six areas: ceramics, graphic arts, plastics, woods, metals and electricity. Activities in each of the six areas utilize a pre-selected product matrix to optimize learning and are designed to include a description of the most prevalent industries in the field, the extent of occupational opportunities and the requisite education for these occupations.

Phase Two. In Phase 2 the students are introduced to selected technologies prevalent in the world of work and the inter-dependence of these technologies. The learning activities of this phase attempt to extend the academic disciplines to the industrial applications of basic science. This phase reinforces the academic disciplines and provides a synthesizing educational experience in the technologies prevalent in productive society.

At the Phase 2 level the learning activities are focused upon the development and awareness of the application of scientific knowledge through the utilization of laboratory equipment such as prototypes, simulated systems, experiments and experimental applications. The technologies represented are: graphic communications, testing, power, power transmission, mechanical, electronics and computer technologies.

Phase Three. Phase 3 provides educational experiences that expose students to the role of man and his function in relation to the technological demands imposed upon organizations and their members as they function in an industrially-oriented society. The learning activities in Phase 3 utilize simulated industrial situations focusing upon various types of organizational structures, decision-making, communications and authority configurations.

Phase Four. This phase provides students with the opportunity to pursue a combination or cluster of technologies in greater depth and breadth within a research and development context. The clusters are selected from phases one and two and are determined by a profile of student ability, interest and performance. The learning activities of phase four generally culminate in a prototype or experimental project interrelating the technologies in the selected cluster.

(2) Physical Facilities and Content Organization.

a. Physical facilities. The laboratory facilities for teacher education are multiple-activity laboratories. With the exception of phase three, each phase of the program has a counterpart laboratory. That is, for example, each of the material areas in phase one, seven technology areas in phase two and three cluster areas in phase four are self-contained and equipped with most modern machines and tools available; each area is, at the same time, not structurally separated from any of the other areas within that phase. This physical organization permits students to perceive the interrelationships of functions, processes and technologies. It is a synthesizing educational environment.

b. Content organization. Content is organized with study from the general to the specific. The study at the systems level is representative of the general; while study at the unit, component and principle levels is representative of the progression to the specific.

Systems are selected with the goal of obtaining representation of each technology in breadth. The study of units allows identification and comparison of the basic systems in each technology area. The study of components and principles provides for the in-depth study of each technology and provides the link between industrial arts general education and the academic disciplines.

(3) Teacher Education Program

The teacher education preparation is a four-year university program. It includes the elements of the teaching act stated by E. R. Smith in Teacher Education: A Reappraisal, and is based on the prospective teacher's entering the program possessing a general and liberal education. A modification of the elements Smith suggests and the provisions for their realization are indicated below:

(a) Relevant knowledge from the humanities and social sciences: (Survey of English literature from Chaucer to the 20th century; structural, cultural and social ranking schemes for analysis of society; problems and theories that have dominated philosophical thought in the Western world; the nature, meaning and function of work.)
(b) Educational application of behavioral and social sciences: (educational psychology, philosophy and administration.)
(c) Relevant knowledge from the behavioral sciences: (trigonometry and polynomial calculus; inorganic chemistry/organic chemistry; mechanical, thermal, electromagnetic and optical properties of matter; nuclear fission and fusion, lasers and space research.)
(d) Specialized knowledge in a particular subject matter discipline: (Phase one - material areas; Phase two - technology areas; Phase three - interpreting industrial organizational structures; Phase four - clusters of technologies and material areas; educational practices and programs in industry and labor.)

(4) Research in Progress

The industrial arts research project is in its third year of operation. During this time approximately one thousand junior high school students have participated in treatment and control groups.

The groups studied were grades seven, eight and nine and represented achievement levels from pre-employment to high-achieving. Both male and female students were participants in the research, with treatment groups taking the University of Alberta program of industrial arts outlined above.

In general, the findings to date are encouraging. The treatment groups achieved higher in academic disciplines and in a measure of the understanding of Alberta industry than did the students in the control groups.

Immediate plans for continued research activities see an expansion of groups and phases. Hard core unemployed, Indian and Metis, and mentally retarded students will be subjects in both phase one and two and also in phase four.

Messrs. Gallagher, Petruk, LeBlanc and Manuel are faculty members of the Department of Industrial and Vocational Education, University of Alberta, Edmonton, Canada.

F-14.1.10 AIAA
Forum of Innovations
THE PARMA, OHIO, PLAN
Chm., Robert W. Fricker; Rec., E. Allen Bame; Speakers, Robert Bergstrom, Glen Buchanan, Otto Furbahs; Host, Roger D. Anderson.

A STUDY OF MANUFACTURING INDUSTRIES

Richard V. Barella
Glen G. Buchanan
Richard L. Stoper

September 6, 1966, was the beginning of an exceptionally active and productive year for our industrial arts staff at Shiloh Junior High in Parma, Ohio. It was at that time that our architecturally modern school opened for the first time. As we moved into the new structure with its new facilities, machinery, equipment, students and staff, it was evident to us that the one thing which marred this newness was the traditional nature of our industrial arts program – a program which involved students from grades seven, eight and nine in the typical courses and laboratories based primarily on woods, metals and drafting.

Fortunately, the three of us were well acquainted with and inspired by contemporary theories aimed at keeping industrial arts in harmony with our changing technological society. With this information and motivation, we began to evaluate our curriculum in hopes of developing a contemporary program which would reflect a change in content, structure, methods and purposes of modern industrial arts education.

Initially we hoped to come up with a curriculum for our junior high school that would be drawn from industry and technology with these three major aims:

(1) To develop in students an understanding of the growth and development of American industry.
(2) To develop in students an understanding of the functions of manufacturing.
(3) To develop in students an ability to solve problems related to the functions of manufacturing.

Because science and technology are producing materials, processes and principles at an enormous rate, we wanted our students to have the opportunity to experience and learn about this growth and development by getting involved in typical problems found in the manufacturing industries.

After considerable planning on the part of the teachers, we combined the seventh grade woods class, an eighth grade metals class and a ninth grade drafting-graphic arts class for one semester. We utilized all three laboratories and a music room for our group lectures.

The students were first oriented to the course with a tour of the laboratories and an explanation of team teaching. They were then combined in the music room for approxi-

mately one week and were given a list of topics that would require investigation. These introductory topics were aimed at providing a broad overview of the growth and development of American industry.

The introductory topics were given with the emphasis being placed on total student involvement. Each student's findings were shared with the entire group through discussions involving all students.

We then began to familiarize the students with the six basic functions of manufacturing: management, research and development, finances, production planning and control, manufacturing and marketing.

The students were then trained to do various jobs on a production line developed by the instructors. This put into reality some of the concepts that had been previously studied. After two days of production the students had a better understanding of jigs, fixtures, interchangeable parts, division of labor, elimination of waste motion, plant layout, quality control and the importance of the individual within the group.

Since all industrial arts students were required to pay a specific laboratory fee, they automatically became stockholders in their respective corporations.

All students were members of the board of directors, and a president and vice president were elected for each corporation.

Throughout the course the ninth grade drafting students were engineering consultants, but were not a part of the actual production team.

After each corporation was organized and met the required conditions, it was given a charter.

Brainstorming sessions were then conducted for ideas of a product to manufacture. Many possibilities were brought forth through individual research. The students made sketches of their ideas, and these were discussed in large and small group discussions. Students needing help with their sketches were aided by the engineering consultants.

Each corporation through an evaluation selected the product it was to manufacture. Rough models were made using many different materials, processes and principles. Then, after selecting a rough model to manufacture, students made a pilot model.

Throughout each function the students kept daily logs of what they contributed and what they learned. Also upon completion of pilot models a patent was given to each company.

Attention was then given to the function of finances. Each corporation elected an accountant or terms of accountants to prepare financial records and reports. All students determined the cost of materials and competitive prices for their product after a market research study was made.

During the production planning and control stage the following activities were conducted; materials were determined, along with the operations; drawings of templates, jigs and fixtures, and safety devices were made prior to their construction; materials were processed for production and a plant layout was made requiring the movement of some equipment; flow charts were organized and developed by each company.

At the beginning of the manufacturing stage, supervisors and dispatch clerks were elected, production standards were set and personnel were hired from the two companies that were not ready for manufacturing. A production quota was set and a trial run of the production line was made. Time studies of the various operations were made and then production of the product began.

After the product was manufactured the company went into the marketing function. Research was done prior to this point regarding marketing. The products were sold, profits were computed, reports were made, dividends were paid and the corporations were dissolved.

Mr. Buchanan is Industrial Arts Chairman at Shiloh Junior High School, Parma, Ohio.

RESEARCH AND DEVELOPMENT— THE APPLIED APPROACH

Otto Paul Furpahs

Many a very important product of industry today has come about because of the opportunity given or taken by some individuals to follow their bent of natural curiosity, to "try and see".

Research laboratories have been devised to take organized advantage of the human propensity to explore; so it would appear to be short-sighted not to have this activity as a recognized part of the industrial arts program.

Development and production problems are usually considered to be in an area outside of research itself, but merging into research activities.

Development covers that work which, using all known information, develops systems or models for the perfection of manufacturing processes and turns out products which will be satisfactory to consumers and which can be sold at a profit. It covers testing, evaluation, styling, market research and application research.

Industrial arts education has an opportunity and obligation to help its students gain an understanding of the basic principles of mass production through R&D. The writer believes that this can be accomplished by the introduction of die-making along with jig and fixture design. The use of advanced classes affords a situation in which a product of sufficient complexity could be chosen that would enable all students to participate.

Also different types of jobs could be listed and discussed along with the necessary training.

Because group production projects involve a range of simple and complex hand and machine skills and different degrees and application of technical knowledge and know-how, all members are able to contribute their strengths to the project. To prepare the classes for this type of situation, outside reading was assigned and class discussions were held to provide a general idea about shop organization.

<u>Group production project selected</u>

The project selected for our mock industrial operation was a duplicator gauge and was chosen with the following ideas in mind:

(1) The project selected is one that is being produced on the commercial market.
(2) The project meets the requirements of an 11th and 12th grade metal shop.
(3) The project is a challenge to an R&D approach.
(4) The project possesses a useful function that interested the students. It is a tool.
(5) The project is marketable.
(6) The project is ideal and lends itself favorably to a mock industrial operation in the shop.

<u>Necessary approach to its development</u>

(1) Brainstroming session.
(2) Sketches of possible solutions to product design.
(3) Scanning sheet of all drawings for product design.
(4) Sketches of possible die design. (all members)
(5) Scanning sheet of possible die designs.
(6) Sketches of jigs and fixture design. (all members)
(7) Pair up class. (11th with 12th grader)
(8) Assignments of jobs and duties. (makes own choice)

<u>Laboratory facilities</u>

The research and development center may properly be an integral part of each unit laboratory. It is the idea center and in larger school systems should be given unit status. In this position it would house charts, samples, models, mock-ups of mechanisms, simple machines as in physics and mechanics, typical structures in various materials, power transmission devices, electrical circuits, hydraulic systems and such elements basic to the development of products and projects. Books, catalogs, manuals, slides and films should be available in the included library for additional resources. The microscope and scientific photography find application in research and development.(1)

Ideas for research and development

(1) Waste stock from a company. (What could be designed from it?)
(2) The company has a simple problem which may be a challenge to a group of students. How could it be done better?
(3) A "Think Room" for students who have similar interests in research and development and patents. (Consultant)
(4) Bring in attorneys for patent information.

Conclusion

Industrial arts is an area in the school curriculum that can demonstrate opportunities for high-level creativity, problem-solving and a study of the vast technology of a predominantly industrial culture.

The creative nature of research and development in an industrial arts program fosters for stu' s a type of freedom that helps to develop physical, mental, emotional and esthetic growth.

Sound and thorough investigative techniques which lead to better problem insight are, in research, valuable learning experiences.

The modern trend in education shows that various aspects of living become more meanin the student when he experiences them as a whole. A research/development program readily justify its continuance and expansion because of the true-to-life experiences it offers the industrial arts student.

FOOTNOTE

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F-14.1.1 AIAA
Forum of Innovations
TECHNOLOGY—GENERATING CHANGE IN THE ELEMENTARY SCHOOL
Chm., Alvin Wutti; Rec., Floyd L. Jack; Speakers, Elizabeth E. Hunt, A. Arthur Stunard, Joseph Dispensa, Jr.; Host, William S. Scarborough.

TECHNOLOGY FOR CHANGE IN ELEMENTARY SCHOOLS

STRATEGY FOR CHANGE

Elizabeth E. Hunt

Education is an invention. It is a man-made solution to a problem. Like other inventions or solutions to problems, education is subject to re-design. This is the thesis of my presentation and the thesis from which the Technology for Children Project developed.

I should like to do three things in this presentation: One, to discuss "design" as a way of thinking. Two, to present the definition of education and the resulting theoretical construct from which we have been innovating. And, three, to show how we have gone about implementing this new design in New Jersey, beginning with what we are calling the Technology for Children Project.

Design, as I think of it, means to find a simple, direct solution to a problem. Or, in other words, it is problem-solving.

I feel a special excitement in talking to you as professional persons in industrial arts about design or the "design way of thinking" because this way of thinking is at the heart of what you and I do every day.

The "design way of thinking" is a powerful way of thinking. We have been exploring in the Technology for Children Project how this cognitive process can be developed in both children and adults. We have had delightfully exciting design sessions with the elementary classroom teachers in the Project and they in turn with their children.

As you know, in using the "design way of thinking", one begins with a definition of the problem. One asks, "What is the problem?" This is the first and most difficult step. It is also the most important step. Something as simple as changing one word in the definition can make possible a better solution. For example, as a definition of what to do with cars that pour into cities every day, changing the definition of the problem from "parking" them to "storing" them makes it possible to develop the idea that elevators can be used to take cars up for storage. This allows for a far better utilization of space.

Suppose you were a designer of airplanes during the days when the propeller, as an airscrew, was still in vogue. Had you sat down to re-define the problem related to forward

thrust, you might have defined it as one of developing a more efficient propeller or yo might have defined it as one of propulsion. The latter definition includes the possibilit of the jet engine as a solution, which when used obviates the propeller altogether as th primary means of forward thrust.

Another example of re-thinking a problem was brought to my attention during th strike of garbage collectors in New York City. The Project staff and I were discussin the problem of collecting garbage. Wesley Perusek offered the information that someon at the University of Pennsylvania is working on the problem of developing and testing th idea of creating slurry to dispose of refuse. This means that garbage from an apartmen house, for example, would be ground and mixed with water or some other fluid, and pipe off to the dump or wherever. Thus, slurry as a solution to the problem would obviate th need for trucks and collectors altogether. Richard Harnack of the Project staff remarked "Say, that would be like a slurry with the fumes on top."

The definition of education (as a problem) which has given rise to the development c the Technology for Children Project and portends further innovation and implementation is this: Education is the institutionalized management of the learning process. This is m own definition, as far as I know. I submit it, knowing full well that one rarely, if ever comes up with an ultimate definition. This is why problems are always subject to nev solutions. This is why the "design way of thinking" is so exciting. Virtually all prob lems can be re-defined, and the better the definition, the greater the possibilities of more adequate solution.

The definition of education as the "institutionalized management of the learnin process" provides us a new field in which to operate. First of all, it zeros in on the learn ing process. This is where the "givens" lie in what educators are attempting to do. We as educators, can no more ignore the psycho-biological bases (or the inherent nature) o the learning process, than the designer of airplanes can ignore the science of aero dynamics. There is, by the way, an old saying in the aviation world: "Give me an engin powerful enough and I'll fly a barn door." Sufficient power applied to a propeller ca pull a remarkably inefficient wing into the air. However, a much more efficient method c achieving flight is to shape the vehicle so that its surfaces produce the greatest am n of lift while creating the least amount of drag. In a comparable vein, some of the mos prevalent proposals for change in our schools have been for a longer school day, year round schools, more emphasis on marks, raising standards, etc. Implicit in such pro posals is that what we are lacking in efficiency in our present management of the learnin process, we will make up either by additional pressures on children or by prolonging th inefficient system for another two or three months.

The learning process is much too complex to discuss to any great extent here, but should like to point out some ideas we have identified from theory and research and ar attempting to implement.

It is theorized, and there is evidence to support this theory, that the active, explora tory, manipulative behaviors of children are neurologically based behaviors. Something i the system seems to demand a steady stream of sensory data input. Sensory deprivatio experiments demonstrate that when the human organism is deprived of all sensory data subjects want "out" after a few hours. If subjects continue to be deprived of sensor stimuli, they become disoriented or hallucinate.

Another idea, closely related and supportive of the importance of exploring or manip ulating the environment, is that the physical environment has perhaps been one of onto genetic and phylogenetic man's best teachers. One reason is that the non-human physica environment is consistent in its response. (This is more than you can say for some hu mans.) If you act upon it in a given way, it responds in a given way, so that principle and laws can be deduced. Not only that, the non-human, physical environment respond only to intelligent behavior. The infant, upon dropping his rattle, can scream his hea off (an emotional reaction), but to no avail—unless the cry brings another hu n bein who responds intelligently to the situation, such as by picking up the rattle for the child In a sense, this non-human physical environment invokes its own discipline.

The intense and persistent exploratory behaviors of children, given a rich environ ment to explore, seem to account for the tremendous amount of information childre accumulate before they ever come to school.

The Technology for Children Project is devising the kind of classroom environmer which utilizes this basic exploratory, manipulative drive by including a wide variety c tools, materials and other items. The energy, the interest, the curiosity of a child is re leased in this environment, to accrue for him information through all of his sensory chan

iels. Gathering data and/or information from the human and non-human environment hrough all sensory channels is, to me, synonymous with learning.

The classroom environment plays an indispensable role in the total theoretical frame-vork and, therefore, has become one of the focal points of development in the Technology 'or Children Project. Fortunately, we have been able to manipulate this environment at vill in the Summer Institutes – to have free rein in demonstrating to teachers what hap-)ens when children operate in this kind of setting. Our classroom demonstration in the exhibit hall is only an indicator of the direction in which we would like to go. It is not considered a finished design of an ideal elementary classroom. It needs further develop-nent and testing. You will also see examples of the kind of classroom situation we are alking about in the film "Design for Learning".

Another focal point of development in the Project is a program of preparation for he teachers. Teachers who have been prepared under our present programs find that to operate effectively in this new classroom environment is a different kind of task and calls for a different set of competencies and guidelines. The Summer Institute allows us freedom to try out the teacher-preparation program that is appropriate for working with children in this new environment.

Much concern has been voiced on the part of teachers, administrators and parents as to what is going to happen to the subjects, or to the broad areas of the curriculum when he learning process is managed in this way.

Six broad areas have been identified as being appropriate for an elementary school curriculum. They are: language arts (sometimes termed the communicative arts), nathematics, science, social studies, music and the fine arts, physical education, health and safety. In the Technology for Children Project, we perceive these broad areas of knowledge primarily as ways of thinking about and dealing with the human and non-human environment. These processes of thinking about and dealing with the human and non-human environment are often categorized as either cognitive, affective or psychomotor. These processes have accrued for man a body of knowledge – or content, if you will – at an exponential rate. These processes of thinking about and dealing with both the human and non-human environment have become another focal point of development in the Tech-nology for Children Project.

It is theorized that if a child (or teacher) develops these ways of thinking about and dealing with the environment, he will derive for himself his own unique content. It will come to him in a way which will have meaning for him. He will be able to relate to the information. Further, by developing these processes of accumulating data, the individual child is in a position to add to his own stockpile of information, rather than parrot infor-mation. Also, as these processes become more finely tuned and the individual's stock-pile of information becomes larger, he is theoretically able to contribute to his culture's stockpile of information.

What are these [illegible]verful processes of thinking that derive for man a body of knowledge at such an explosive rate and enable him to control the physical env[illegible]ronment at greater and greater levels of sophistication?

One, which I have already mentioned, is the "design way of thinking". Another is the "scientific method way of thinking". Another is mathematics. This is a system of logic so powerful that through mathematical calculations, for example, the existence of a planet and electromagnetic waves was predicted prior to actual "discovery".

When we begin to identify specific ways of thinking, it is obvious they parallel in part the broad areas of the curriculum. I discovered recently in an art course that my failure to render a decent oil painting was not due to an inability to apply paints to the canvas, nor to my eyesight, but due to the fact that I was not <u>perceiving</u> the objects to be painted in the most effective way.

What I am about to say is at the heart of the theoretical construct from which we are innovating.

The classroom envi[illegible]nment which includes a wide variety of too[illegible] and materials and other concrete items and a[illegible]ows children the freedom to interact [illegible] with these ma-terials in both directed and [illegible]-directed ways is the raw material or [illegible]" out of which all of the cognitive, affective and psychomotor processes represented in the broad a[illegible] of the curriculum [illegible] be developed. This theoretical construct indicates the dir[illegible] are takin[illegible] in the [illegible]ology for Children Project.

I sh[illegible]ld like to move from the theoretical level of this presentation to what is actually being im[illegible]mented in the Project at the present time.

There are two distinct pha[illegible] in the Technology for Children Project. One is the

Summer Institute of Technology for Children, where we bring children in to try out newly-developed classroom environments. The primary purpose of this, however, is to provide a selected group of classroom teachers with the opportunity to observe children (guided by an industrial arts and elementary classroom teacher) dealing with a tool/material environment.

The second phase is a follow-up of the Summer Institute. The observing elementary classroom teachers, during the academic year following the Institute, become the key contributors to the Project by trying out the theory in their own classrooms. The teachers have the "on-call" assistance of three Research Associates in Technology of the Project staff.

How well are we implementing, with the two phases of the Project, the theoretical construct I have described? In answering this question, I shall use the focal points of development which have been identified.

The first focal point of development is the classroom environment. As I have indicated, we have been able to manipulate the environment of the Institute to the extent of our ingenuity and ability to acquire the materials to put into it. Each Summer Institute classroom environment becomes progressively better. The classroom environments of the elementary classroom teachers in the Project during the school year have all been modified uniformly in several ways. They have all received custom-designed and -built tool panels, workbenches, worksurfaces and sawhorses. They have all received a recommended set of tools. Other than this, the modification of the classroom reflects the individual teacher's own ideas. Theoretically, I envision a classroom without desks. (After all, how much sensory data input can one obtain from a desk?) We do remove the desks from the classroom in the Summer Institute. Children are still able to read and write when necessary. They write on the surfaces they work on. They write on the black-board, typewriter and by setting type, ABC blocks, etc. We will be getting closer to a fullblown implementation of the theory out in the classrooms when all of the teachers attending the Institute are able to modify their classrooms at least as much as the class-rooms in the Summer Institute are modified.

The second focal point of development is the preparation of the elementary classroom teacher. We determine the effectiveness of our program of preparation for the teachers in the Summer Institute, in part, by what the children do in the classrooms during the school year following the Institute. What the children are actually doing in the classroom at this point falls on a continuum from simply "making a project" to using the "design way of thinking", or problem-solving approach, extensively.

Given the classroom environment as we envision it, and the kinds of activities which can be initiated in this environment, a classroom teacher has an inherent way to help children develop the cognitive, affective and psychomotor processes reflected in the six broad areas of the curriculum. How to prepare the classroom teacher to do this is at the cutting edge of our efforts and is the problem we have set for ourselves in the 1968 Summer Institute program.

The final focal point of development is to institutionalize the findings of the Project – particularly the program of preparation for teachers. Not until this happens will we truly have effected any changes in elementary education.

It may now be apparent why the idea of a technologically-based environment for children is such a potentially powerful one. It is the wherewithal the teacher needs for helping children develop the most effective ways of thinking about and dealing with the physical and social environment.

I have no faith in a presentation such as this as an effector of change. However, it must also be apparent to you, as industrial arts educators, that your role is cardinal in creating the most potentially productive learning environments yet devised for children.

If this presentation has brought about an awareness of this, or the desire to try this out, then our time here will have been well spent.

Dr. Hunt is Director of the Technology for Children Project, Division of Vocational Education, NJ State Department of Education, Trenton.

EFFECTING CHANGE THROUGH THE ELEMENTARY

CLASSROOM TEACHER: INSTITUTE PHASE

E. Arthur Stunard

If education for children is to have a brighter outlook today, it must be through our elementary classroom teachers. The elementary classroom teacher must feel a need for curriculum change and, in the final analysis, be the one to initiate new learning techniques.

If technology is ever to make an impact at the elementary school level, industrial arts educators must become increasingly concerned with how to change elementary teachers, in addition to being set on developing consultants to work in classrooms.

The established hand-mind dichotomy is a strange one. Every legitimate activity and profession involves the human being in some form of manipulation. The classroom teacher often does not recognize the values of real experiences of construction and active problem-solving, therefore he tends to stay away from this type of situation, relying on the more comfortable, traditionally academic approach.

Up to now, college and high school curriculum seems to stress the abstract forms of education as being the scholarly thing. Consequently, the elementary classroom teacher has never had any real training within the active framework of concrete learning or experiences.

The task of changing this thinking on the part of teachers is a monumental one, and cannot be accomplished by just a four-week workshop or a single three- or six-semester-hour college course that is in fact relatively unrelated to the classrooms as they exist in the individual school districts.

Many educators have latched onto these unrelated courses as cure-alls, and neglect their responsibilities by not providing programs for change.

The emphasis in elementary industrial arts should be placed on both pre-service and in-service training to help prepare elementary teachers, so they may assume primary responsibility for implementing this type of program.

The teacher needs sufficient time to offset the basically academic approach presented in his college experiences. I am convinced it takes a minimum of two six-week institutes plus ongoing follow-up with actively supportive consultants, during each successive school year, truly to change the classroom teacher. The short three-hour course can be helpful but at the outset leaves much to be desired in terms of real change that will affect children in the classroom.

Much of the research being done at the elementary level to prove or disprove the value of industrial arts activities seems to reflect this basically superficial approach to teacher education, in that we are being hard-pressed to show some significant difference in the learning that takes place.

The Institute of Technology for Children is only one part of a program intended to change elementary classroom teachers, not through indoctrination but rather through mutual exchange of sound ideas. The elementary classroom teacher requires a minimum of two years (two institutes and two successive school years with children in the classroom) to become truly changed and ready to initiate a program of this type with elementary school children. This change may seem slow, but effective change is slow. I can no longer accept the notion that I can have elementary teachers in a three-semester-hour course and affect them enough so they will do all that is necessary to cause a significant difference in their classrooms.

In a program of change, talking or lecturing is at a minimum. Doing, acting upon, observing and questioning is at a maximum. Respect for each individual's thoughts is a must, and change begins to happen when all new ideas are exposed and proved to be sound.

What is in an institute and how can it most effectively cause change? The job it must do is far greater than just presenting a body of information for digesting by program participants. The total learning environment must be stacked in such a way as to cause change to each person in attendance, and even more important, at individual rates.

It was gratifying to read, in the October 1967 PACE Report, some comments from Carl Rogers, of Western Behavioral Sciences Institute, which reflect very adequately the attitude that must prevail during the experience of this institute. I quote:

> "... the goal of education should be to develop a society in which people can live more comfortably with change than with rigidity; therefore, we must develop a climate in which innovation is not frightening.

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Under the intensive experience approach, groups of individuals live and meet together for periods of time ranging anywhere from a few days to several weeks. The emphasis is on interaction among the group members. Interaction takes place in an unstructured atmosphere that encourages each participant to drop his defenses and facades, and thus enables him to relate directly and openly to other members of the group – hence, the basic encounter. As a result of such training, individuals come to know themselves and each other more fully than is possible in the usual social or working relationships. The climate of openness, risk-taking and honesty generates trust. This enables the person to recognize and change self-defeating attitudes, to test out and adopt more innovative and constructive behaviors.

When asked how an intensive group experience would differ from group therapy, Rogers replied that 'the people who participate in our intensive group encounters have not come for help; They are already functioning normally. They're simply trying to develop themselves further'."

Similarly, during each Summer Institute of Technology for Children, the teachers in attendance appear voluntarily, and approach this experience with a non-hostile attitude. It must be up to the professional leadership to see that the teachers maintain this attitude. The attending teachers are selected and are quite competent in their field. They become part of an environment that allows them to expand their information and experience base, as well as incorporate some totally new concepts. The learning setting is basically an informal one, in which every participant, classroom teacher, professor, director, assistant director, etc., is considered to have a valuable contribution to make. No idea is left unexplored. The persons in attendance must not be treated in the typical student-teacher relationship.

The changes that take place during the six weeks in attendance are great and need time to develop and, most important, to develop internally through a commitment of the participant that this idea does have merit, and a belief that it must be developed with children.

Several of the many ingredients to be planned for become extremely important if the elementary classroom teacher is to see the value and utilize the advantages of technology for children in the classroom.

The first ingredient is to become acquainted with technology as a possible introduction to the elementary classroom. Discussion centers around past and present philosophy of elementary industrial arts, and an effort is made to establish a theoretical base for operating with children in this way. The newcomer has a rather sketchy and often a "crafts"-oriented idea, toward tool/material experiences, but is encouraged to communicate his thoughts with the understanding that he may at any time change his ideas, hopefully for better ones. During this period the participant begins to get a vague idea of what he will be involved in, and at least has a point of reference for change.

The central theme of the program is essentially that of problem-solving. Each participant is posed with a series of problematic situations which include both tool and material experiences. While tool manipulation is important, a high degree of knowledge about any specific one is not critical at this point. Tool skill is not the main objective, but rather that the newcomer knows of its existence and that through a problem-solving approach, he can apply his knowledge to whatever task needs to be accomplished.

Large group demonstrations are not generally used because of their ineffectiveness in a creative, non-directive approach. Showing a student how to use a tool when he may not need it for some time, is purely a waste for everyone concerned; a sort of individualized instruction must go on at all times.

While the participant is encountering tools of all sorts, he simultaneously is using materials and faces more problems that must be solved. His total effort is toward building a storehouse of information that can ultimately be applied to the many situations that will occur in the classroom.

We avoid lecturing to the newcomer as much as possible. The participant, during laboratory sessions, is constantly exposed to tools and materials and is always provided opportunities to ask questions and investigate new avenues. As new materials are exposed, simple problems relative to it are posed; answers and solutions are discussed afterwards with the entire group.

During the period of exploration, problems get more intense, tool use increases as self-confidence is gained, and, beyond this, the student begins to know what is available to him, for future recall.

As the period of experimentation is extended, any material of industry is legitimate. The important goal here is to develop a way of thinking and dealing with our environment. The new classroom must be a much richer environment than just the rows of desks in the more traditional classroom.

It is extremely important to note that whenever people are subjected to new experiences, such as the tools and materials of technology, they automatically go through a feeling of inadequacy, a feeling that everyone present knows more about the area than they do. It is vital to recognize and plan for this period.

One of the primary objectives for the professional staff is to provide successful experiences, experiences that will progress slowly, if need be, from the very simple to the very complex. Each participant must walk away from this activity feeling as though he accomplished something worthwhile, and have the confidence to try another on his own.

The institute is established each year in an elementary school, and the classrooms are modified, as was demonstrated in our classroom here at the convention, to simulate the setting the ideas will be tested in during each school year. For the purpose of the institute, such rooms are identified as elementary classrooms, adult classroom, library, movie preview room, materials preparation room, laboratory, small conference rooms and an office to act as the coordination center. It should be emphasized here that no industrial arts shop is required or set up. The elementary teachers would not be prepared to use it, and since they will be returning to schools without such facilities for their use, it would serve little purpose. Perhaps later in our development, as school districts begin hiring consultants in technology, a need may be evident.

Another important ingredient in the institute experience is the children. In order for the elementary classroom teacher to change, he must be aware of the alternatives. As you have seen in the film "Design for Learning", some of these alternatives are demonstrated. Although the children are gaining much from their experience, the primary reason for having them at the institute is to let the teacher observe how children operate in this setting. The classes are arranged in such a way that they represent all levels of learning, K-6, and are divided into primary or intermediate classrooms. Each classroom, of which there are four, is directed by a master elementary teacher, and an elementary industrial arts specialist. The desirable outcome is to have each participating teacher see the resultant activities develop through these two specialists, with the elementary teacher assuming the major leadership role. It is hoped that with the experiences of the institute and the services of a consultant provided by the Project, the participating teachers will be able to conduct similar activities upon returning to their classrooms.

During the four weeks that children are present, each teacher is asked to select one child to observe, and to keep an anecdotal record of his activities, for at least one and one-half hours each day. The record is kept under standards established by child study specialists, who help these observers develop good record-taking procedures, and becomes clinical evidence of the learning activities of that child. During this data-collecting period, extreme care is taken not to formulate any conclusions. This is done through group discussion, with the services of a child study specialist. The ultimate goal is to help each teacher develop impartial observation techniques.

After four weeks, the participant prepares an abstract of the data he has accumulated, selecting only one area of the established curriculum, and draws out all evidence supporting this aspect of learning. The conclusions overwhelmingly support the selected area and make it quite evident that science, mathematics, etc., have taken place without specific times being set aside, and generally at a much higher level than expected.

This observation phase of the institute has many more values than just verification that learning has taken place. To mention just one, it is an excellent opportunity for the professional teacher to look at a child in an objective way and to see him as he really is — living, active, investigating, constantly digging for facts, moving things around, putting things together, feeling, smelling and sometimes being a very mischievous fellow.

The idea of technology becoming an integral part of the elementary school program is not new, but the thought that technology can be a base from which to develop all areas of learning that might take place in the school environment is unique. It is no longer possible to think in terms of adding technology to the curriculum; a much broader concept must be developed.

The Technology for Children Project, through its institutes and follow-up activities, is attempting to develop curriculum which allows children to explore the "world" and, more specifically, to be significantly challenged in the classroom. Classrooms of the past have traditionally provided for children all that seems to be against their natural

way of learning. The classroom of today need not be organized in the usual subdivided arrangement we have generally accepted as best, and the teacher should be free to get at what needs to be done, that is, to enrich the environment so every child can interact with everything that stimulates the learning process. A key point to establish is that technology in the classroom provides a total learning environment that pulls on all areas of the established curriculum.

I have spent a great deal of time describing the learning process of the Institute of Technology for Children, and how change might take place, with practically no reference to vocational education. Vocational training is inherent in everything that children do during construction, writing, describing, investigating, etc. Children, being the generalists they are, would rather become involved in the world of work than be told about it. The learning process I have described here allows children to have exploratory experiences which enable them to become part of the world of work.

At the elementary school level, we operate farther away from the stereotyped image of vocational education. There seems to be little need to concentrate all the effort on any single specific vocation. All vocations are legitimate for study and there is little supportive evidence for singling out any one, in view of the fact that the average person is likely to change his life work at least three times before retirement.

The Technology for Children Project is attempting to identify some of the general learning that would carry through all future vocational endeavors. The vocational educator can find further comfort in that this program will provide technological options to all children in the elementary program, which have been left out, for more "academic"-type instruction.

The emphasis should be placed on exposing all children to as much as possible, in order to give them the input they need to make intelligent choices for the future, and this input should be wide open.

The challenge I pose to everyone in this room and to education in general is to effect change in the learning process, rather than trying to fight only for singular vested interests.

Mr. Stunard is Assistant Director of the Technology for Children Project, NJ State Department of Education, Trenton.

EFFECTING CHANGE THROUGH THE ELEMENTARY CLASSROOM TEACHER: CLASSROOM PHASE

Joseph Dispensa, Jr.

The Technology for Children Project is comprised of two distinct phases. One is the Summer Institute of Technology for Children, which we call the "Institute Phase". The second phase, which follows the Institute, is called the "Classroom Phase".

My portion of the forum presentation is to describe what happens in the Classroom Phase.

One of the unique features of the Summer Institute Program is that it is designed to initiate a technology for children program within the classrooms of a given number of elementary classroom teachers. A commitment, in writing, is obtained from each classroom teacher attending the Institute, to the effect that he will, following the Institute, implement the program with his children throughout the school year.

My position as Research Associate on the Project staff is to provide "on-call" assistance to these teachers in their classrooms as they attempt to implement the program.

In order to provide the most effective assistance for these teachers one must get to know them individually and their ways or styles of operating with children. However, at the outset of my assisting them, I am aware that the following conditions usually exist with each teacher:

(1) Through the experience of taking an anecdotal record of a child's responses to his Summer Institute experience, the teacher has seen how learning can take place through manipulation of materials;
(2) The teacher has had the experience of both observing children using tools and materials and of manipulating them himself;
(3) The teacher's classroom environment has been altered to include a workbench, worksurface, tool panel and tools;

(4) The teacher has had no previous experience implementing the Technology for Children Program in the classroom environment.

Each classroom teacher generally returns to his own classroom on shaky ground. He has little confidence in his ability to ignore his formal teacher preparation and previous teaching experiences. We have asked this person to venture anew in what may to him be a strange approach to learning. He feels pressured by the other teachers to bring his children up to so-called "grade level", even though this Project participant has written consent of the school administrators to permit him to stray from the traditional curriculum patterns. The change in the classroom environment has made it more difficult for him to keep his classroom organized, in that it is different from the classroom which does not include manipulative activities. Because of his lack of experience he has problems ordering materials and setting up a special account for supply expenditures. Also, the classroom teacher has had limited experience using tools and has not had the opportunity to teach children how to use them. He usually feels greater confidence in repeating the activities which have been demonstrated, or those he has done himself in the Institute. He knows, however, that the real test of his confidence is to venture into something new. Of course, not every teacher returning from one summer institute has all of these fears, but it would be unrealistic to assume they do not exist, at least in part.

The Research Associate's stance with each teacher, as we see it, is unique in that his goal is to work himself out of a job. In other words, the Research Associate is attempting to bring the classroom teacher to a position of being able to operate within his environment with increasing confidence and independence. The Research Associate values and encourages the efforts of the classroom teacher. He is not critical of what the classroom teacher has previously done. The Research Associate attempts to ask questions that will lead the teacher to solve his own problems and thereby become less dependent on the consultant. The Research Associate in effect is applying "the design way of thinking" in his relationship with the classroom teacher. He helps him to define the problem and when necessary guides him to solutions.

If the Research Associate does try to take over a class, one of the probable results is that the teacher will pull back and will have reinforced doubt about his abilities, especially if he compares the technical expertise of the Research Associate with his own, and minimizes his expertise of knowing children and how to work with them. It takes time to develop what is in effect a team relationship.

The kind of manipulative activities which children can do are countless. Which activity to develop depends a great deal on what the particular child (or children) considers important and in what direction the sensitized teacher feels her students should be moving.

There are many ways by which ideas may originate. Among these are student-initiated; teacher-initiated; consultant-initiated. All sources of ideas are welcomed and can be successful. The determining factor is "do the students feel that the problem is one that they have chosen to find the answer to." Ideally, the inspiration for activities should come from the students, although obviously, not all of it can. We recognize, however, that children-initiated activities are among the best because the children have created the problem and are totally involved in finding the solution.

We are convinced that the least effective way to initiate tool and material activities is for the classroom teacher to tell his class what they are to do. This makes the class altogether dependent on the teacher, since they feel he knows all the answers to the problems and they want to give him exactly what he wants. Statements such as, "Is this right, Mr. Smith?" or "What do I do next, Mr. Smith?" are indicators that the activity is not one that children have questioned or created, and their involvement is superficial. On the other hand, statements such as "Do you think this will work, Mr. Smith?" or "Which way would you do this, Mr. Smith?" are indicators, of a sort, that the children have asked the question themselves or have taken possession of the problem and show signs of intense involvement.

Activities which develop from a rich tool/material classroom environment inherently present problems. Having teachers and children become aware of the problems and become involved in solving them is the beginning of an effective learning situation.

Mr. Dispensa is Research Associate in Technology with the New Jersey Department of Education, Trenton.

F-15.1 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS AS APPLIED TO TEACHER EDUCATION
Chm., Tad H. Herring; Rec., L. Kent VanMeter; Speakers, Ronald W. Stadt, Kenneth R. Clay; Host, R Mondell Coger.

EVALUATION IN TEACHER EDUCATION

Ronald W. Stad

It is very difficult to do anything but describe a series of disjointed ideas when giver an assignment such as this one, but because disjointed presentations are soon forgotten, I'd like to take a few minutes to couch what I have to say in a somewhat basic system o ideas.

I am going to talk about evaluation of a univers department which has as its major function the education of industrial arts – better cal man, technology and enterprise – teachers and, as related functions, graduate study and re earch. Before getting down to specifics, I'd like to submit two very fundamental princ s which far too few business executives – let alone university department chairmen – are willing to accept.

(I) The first principle is a very simple one: There are no results within the department; there are only costs. Results exist only on the outside – in the schools and elsewhere where the department's products teach, conduct research, and adm ster educationa programs and where the de artment's research and consulting services are utilized.

In a few minutes I'll indicate what this first principle means for evaluation in teache education. Now I want to define the second principle.

(II) It is simply that departmental activity is a social rather than a physical activity the department is a unit of the social rather than the physical world. This obvious statement appears, at first blush, to be innocuous. But, in fact, it has great import. The principle implies that events in a university department follow the "normal distribution" o social events rather than the "normal distribution" of events in nature. They do no follow the Goussian bell curve. They follow a curve in which the great bulk of results – say 80% – is produced by a very small minority of phenomena generated by a small minority of the staff.

An example from business will clarify this principle. A business that markets 25,000 products will invariably get 80% of its total orders for no more than a thousand o its products. A retail business with 10,000 outlets will get 80% of its business from four hundred of the outlets.

In a typical university department a very small percentage of the staff – and always the same men – produce three-quarters of all the acceptable, meaningful teaching, research, publications and service (at ten per cent of the cost). This fact has very clear, very pointed and very significant implications for evaluation in teacher education.

I'd like to move then to a discussion of implications for evaluation, with emphasis or the teacher education function of the university department.

(A) From the fact that only costs result within a department, it follows that five, ten and twenty years down the road we will be much more cost-conscious than we now are Longer than most of us care to into the future, but sooner than we would guess, the unit of measurement is going to be bit of information communicated and retained per student hour per departmental cost. At some far distant time, we will not worry about retention but will be concerned with the student's continual evaluation of concepts in his ever-changing system of ideas regarding his vocation. We'll be measuring these very complex phenomena one day.

Southern Illinois University can already make innuendo to the State Board of Higher Education about producing hours of credit less expensively than several of the other institutions in Illinois. Our central administration can get computer output on costs per credit hour accumulated in each department and is only a few steps away from making the evaluation on individual staff members. It is still possible for chairmen and deans to sell rank and pay increases, in part with qualitative bunkum, but each year, the requirement for hard data becomes greater.

People who make rank and pay decisions want to know the number and type of publications, the number of people who attended speeches given by the staff member, the number of quarter-hour credits accumulated, the number and type of committee assignments, the number of graduate student committees, the number of recruitment trips and number of potential students contacted, the number of – you name it. Sooner than we think they are going to have the information.

This movement in American higher education means that we must begin now to evaluate teacher education effort against the following kinds of cost-related criteria:

1) Does the department offer a minimum as opposed to a maximum number of courses to assure optimum utilization of courses elsewhere on the campus, maximum class size, ease of scheduling, ease of staffing, etc.?

2) Does the department offer courses as infrequently as possible – considering that students must be afforded the opportunity to take necessary courses dur g the limited time they are on the campus?

3) Does the department conduct only significant research to assure minimum expense and maximum short- and long-range knowledge additions in its field(s)?

4) Does the department utilize the technology of instruction to maximize learning and reduce costs?

5) Does the department conduct courses with a minimum rather than a maximum of classroom and laboratory space, equipment, maintenance and utility expense?

6) Does the department utilize para-professional personnel such as graduate assistants, laboratory technicians and classroom aides, and non-academic personnel such as administrative secretaries, secretaries, stenographers and file clerks effectively to reduce costs while increasing learning and services?

(B) A second ir plication of the fact that only costs result within a department is that the important results, i.e., what graduates do in the educational enterprise, must be evaluated – before, immediately after and long after graduation. We have to be much more sure of teaching and other abilities of professionals and para-professionals who leave our departments in future. Whether it comes before graduation, immediately after, or is done as an integral part of the next degree, internship in actual professional situations has to become a continuing aspect of evaluation (and inst ction) in industrial arts teacher education.

Results have to be measured all along the line on a unit, course and program basis but the most important evaluation, i.e., evaluation of the completed product before it goes into more or less independent service, must be more realistic and more thorough than it now is in what we call student teaching.

As before, the evaluation during internship will be twofold. On the one hand, the near-professional will be held to high standards of subject matter competence and on the other he will be evaluated according to standards of pedagogical prowess.

Subject matter competence

The intern of four, eight and eighteen years from now will be expected to understand units within, and the totality of, the economic-productive scene in ways of which people in the behavioral sciences (which study industry, trade, business, commerce and other productive institutions) have only dreamed. Our majors (and consequently our staffs) are going to be evaluated against criteria of understanding (not control) of major aspects of productive society, i.e., important segments of the world of work; (1) according to size of organization, from the small, local firm which employs a limited number of workers to the large corporate enterprise which employs thousands of workers and operates at the international level; (2) according to degree of mechanization, from the organization which produces custom goods or services to the organization which mass produces goods on continuous, highly automated production lines and seldom redesigns products; (3) according to type of institution, e.g., financial, governmental, religious, educational, recreational; (4) according to degree of vertical integration with reference to primary, secondary and tertiary operations; (5) according to degree of horizontal integration with reference to diversity of goods and/or services produced; (6) according to major materials, e.g., rubber, metals, plastics; (7) according to major processes, e.g., mining, data processing, communication, casting, repair; (8) according to major products, e.g., automobiles, appliances, toys, missiles. These are only a few of the ways future professionals will be expected to understand enterprise.

These and many other categorical systems, singly or in combination, are useful tools of analysis for the sundry purposes one might have in analyzing productive society. The

intern will have to display facility with categorical systems which have been established by specialists of many kinds. Some of the specialties which study productive society are: sociology, psychology, political science, economics, psychiatry, anthropology, philosophy and theology. Each of these specialties has developed several methods of classifying segments of productive society. Our products will have to display yet undefined combinations of analysis systems from these and other specialties.

Specific evaluation methods are difficult to describe at this juncture. Thus I am glad that such is not my task. An example of how we might measure the kind of understanding I'm attempting to describe will serve to illustrate several kinds of techniques.

On March 13, Rupert Evans and I were fortunate, after debating the inclusion of vocational education in the secondary school at the ASCD meetings in Atlantic City, to meet David Bushnell and share a limousine seat with him across New Jersey to the Philly airport. During a stimulating discussion of industrial arts and other educational miscellany Dr. Bushnell made one statement which I shall never forget. He said – I have forgotten the exact wording – that one ought to be able to understand industry the way one is able to understand Dulles International Airport when he approaches in a cab or limousine bus. I remember this comment because enroute to Alberta from the ACIATE meetings in Washington several years ago and since, when I have flown out of Dulles, I have had the same thought. Dulles International Airport is a very good example of the kind of understanding we must demand of our products.

Our graduates should be able to understand the designer's thinking, which is evidenced in the straight-line flow of baggage and passengers. They should understand the function of auxiliary facilities, of redcaps, clerks, custodians, reservations clerks, and all the other uniformed people who serve passengers and associates.

At Dulles, the kind of understanding I am alluding to is easy to come by. There are many production facilities which are nearly as easy or as easy to understand as Dulles but I don't believe there are any more easy to understand. The Salerno-McGowen Biscuit Company plant in Chicago is a good example of straight line production, from as many as eight railway flour cars on one end to dozens of semi-trailer trucks on the other end. People have high level understanding of such a facility after even a cursory tour. But this is a rather simple and certainly a small plant compared to the National Biscuit plant on the opposite side of the city which has dozens of ovens hundreds of feet long instead of three.

The industrial arts – better man, technology and enterprise – intern must be evaluated to assure that he understands more complex and less well-designed productive units and understands even Dulles and Salerno in many more ways – the ways I alluded to a few minutes ago – than does the casual observer.

Grossly described, the method of evaluation is going to have to be subjective with as much detail as possible. The intern will be taken to a large department store, a mail order warehouse, an appliance factory, a corporate farm or agricultural test station, an underwater research farm, a space station, a government agency, a church publishing house, and so on. He'll be expected to tape a narrative of what he sees, using analysis techniques from industrial social-psychology, management, economics, cultural anthropology, and – hopefully – yet-undreamed-of analysis techniques from industrial arts to demonstrate understanding of the subtle forces at work, which are hidden from casual observation and are unknown to the typical airline traveler or housewife on a plant tour. Interns will have to display understanding of the planning, financing, organizing, staffing, training, controlling and testing functions in sundry segments of productive society, i.e., in all manner of enterprise.

Pedagogical prowess

The intern's pedagogical prowess will have to undergo a more fundamental change during the final third of the century than will subject matter competence.

During the early part of his career, he will throw out most of what he knows about productive society and replace it with new subject matter content. This is as it has always been and should be – but at ever increasing rates.

Pedagogical prowess will change in a different way. Whether you like it or not (and, frankly, I delight in it), we are moving toward the day when the front-line teacher is a classroom-laboratory operator, when curriculum is determined by a combination of forces exerted by (1) federal agencies, (2) a few university-conducted projects, (3) a select group of omnipotent publishing houses and (4) to a lesser degree than now, a limited number of laboratory equipment manufacturers and distributors. We are farther from a

national curriculum than most curriculum areas, but we are getting on the band wagon to assure a part in the orchestration.

Because we have only begun to move in this direction, we have to continue for a time to evaluate interns against the rigorous and somewhat unrealistic pedagogical criteria of the present. We have to expect the individual teacher to be able to discover knowledge about segments of productive society with which we have not been concerned, organize parts of that knowledge into manageable units of instruction, select appropriate methodology and set the educational enterprise into motion, and finally test his own results.

Twenty years from now the classroom-laboratory operator will not do his own curriculum design, instructional planning, methods engineering and quality control work. Other segments of the profession are rapidly developing specialties in these and other areas, and the teacher is becoming like the front-line foreman in manufacturing and construction in many ways. For a time, industrial arts will not be as sophisticated as other parts of the total profession; ultimately, it must be more sophisticated to assure an increasing share of the education pie.

Therefore, we should continue the evaluation of the intern who has taped a narrative resulting from visitations along these lines: he should be required to dig broadly and dip deeply into the literature for and about the segment of the economy he has visited. He may study frozen foods, metal stamping, heavy forging, wholesale drugs, or any of hundreds of other segments of the economy. Ultimately – say in six months or a year of internship – he should come up with five to ten hours of well-tested instruction, consisting of films, readings, illustrated lectures – the works – and evidencing some of what is known by exact and behavioral scientists about that segment of the economy. His work should be checked by industrial arts teacher educators and related professionals all along the line with methods which are already highly developed in the educational enterprise, business and other professions.

Many of this first crop of interns – say about five years' worth – will evidence career patterns something like this: two years teaching in a junior high school, one year teaching in a high school, two years of para-professional work while earning an advanced degree or interning for a second or third time and then work as a teacher educator, or a curriculum specialist in a federal or state agency, or in a large school district, or as a subject matter design and development analyst in a publishing company, or some such work with a laboratory equipment manufacturer-distributor.

As our next few sets of graduates move, five and ten years from now, into these kinds of specialties, evaluative techniques relative to the future classroom-laboratory operator will change accordingly and we will need to develop many new evaluative procedures for the new kinds of professionals (and para-professionals) who will be doing supervised internships in government agencies and school systems and with publishers and equipment manufacturers. The evaluative techniques will be new primarily in the sense that they will be new applications of techniques already used by others who prepare professionals. In the main, evaluation will be conducted after the fashion of our more performance-centered enterprises – DuPont, General Motors, Sears and Roebuck – the leaders in any field you care to mention.

The more salient features of the evaluation scheme will be a continuing management audit. It will consist in part of quarterly or perhaps more frequently scheduled and carefully planned, heart-to-heart, man-to-man, supervisor-to-subordinate, chats about everything that impinges upon the production of goods and/or services in the segment of the educational enterprise for which the subordinate is responsible. His personality, his abilities for planning, coordinating and controlling the work of his own subordinates, his individual production in writing, research or whatever, these and many other things will be evaluated via the give-and-take of performance-centered discussion. Each quarterly chat will be recorded and the recording, together with concluding comments in the discussion, will result in a written plan for continuation and improvement over the next period. This plan, together with additional, timely ideas from the superior and the subordinate, will form the basis for the next regularly scheduled chat.

The superior will use results of this procedure for comparing subordinates and making decisions relative to transfers, rank and pay increases, part or full-time instruction, and ultimately the selection of his own replacement, assuming that, in turn, his superior, and his superior's superior are making similar evaluations and everybody will be moving up.

If we in teacher education move rapidly to establish programs for preparing good classroom-laboratory operators, para-professionals and the higher-level professionals

I have described, at the same time, we will be responsible for establishing criteria which we and employers alike will use to evaluate specialized professional endeavor. No matter what the specific direction of our efforts may be in future, we must conduct follow-up studies regularly to enable continual assessment of each of our major efforts. Questionnaires, patterned interviews, career pattern analyses and other tested techniques will be used much more extensively than now.

(C) A third implication for evaluation stems largely from the second principle, that is, from the fact that 10% of the staff produce 80% of the results. Members of the departmental staff should be made fully aware of this fact and should be evaluated in terms of individual contributions. Individual evaluation will consist of a combination of the numerical data I referred to when I discussed cost analysis and of the quarterly chats I described when discussing evaluation of first-, second- and third-time interns.

The individual staff member will be led to understand his role much more clearly than he does now and will be helped to understand the ideal situation wherein each staff member would produce equally, according to a very high standard. Although no department will ever realize a situation wherein everybody rows the boat with the same force, the evaluation process will help individuals who are not pulling their share of the load to understand that they must produce or be looked over when plum assignments, rank and pay increases and promotions become available. We have enough good schema for merit rating and are going to use it.

Conclusion

At the outset of these remarks I made a case for two principles: (I) that only costs are generated within a department and (II) that departmental activities are social, not physical. These led me to observe (A) that evaluation should entail careful cost analyses, (B) that what really matters is what graduates do in the educational enterprise and that this should be evaluated much more carefully, subjectively and thoroughly over a longer time than it now is both in terms of subject matter competence and pedagogical prowess and (C) that staff evaluation should be akin to intern evaluation and should help non-achievers to contribute more effectively to results – or else.

A fourth new concept in evaluation in industrial arts teacher education has been orbiting in my head for some months and, having failed to fit it into the structure for this presentation, I want to tack it on here. It is not unrelated to my previous remarks and may be more important twenty years from now than the other three concepts I have introduced.

I'm talking about accreditation. Voluntary accreditation is very much a part of education from pre-school school to teacher education. In other professions, colleges, schools and departments are really not free to decide whether they want to be accredited or not. Even in para-professional areas, such as dental hygiene, programs must be accredited by the professional association.

The whole of education and teacher education specifically will be moving toward compulsory accreditation. I hope that the subject matter departments of the NEA will take increasing responsibility for accreditation of school programs and that accreditation of industrial arts teacher education programs will become a function of duly selected teams of ACIATE members. A profession must police itself and the more developed professions do it via professional associates, not via separate bodies. We need a unified approach to accreditation and can only get it through ACIATE.

Much of what I haven't mentioned in my remarks about evaluation will be evaluated by accreditation teams – hopefully teams from the ACIATE. Some of these are: (1) Size of staff – departments with fewer than eight or perhaps ten full-time men or the equivalent will not be accredited. (2) Quality of staff – staffs with only one or two men with the doctorate won't make the grade. (3) Staff load – ten contact hours per week will rapidly become the norm. (4) Budget – here the team will look at other departments on the campus and flunk the department that doesn't have staff, equipment, travel and other budgets comparable to medicine, engineering, etc. – on the basis of standards such as quarter credits accumulated. (5) Equipment – here the team will not look at amount, size and variety of equipment so much as at representativeness, flexibility, safety, pedagogical appropriateness and the like. Departments which try to duplicate job shops will be chastized, because equipment has to be more like undergraduate physics, chemistry, and engineering equipment and not at all like production equipment. A new circle saw or even a uniplane won't impress the team as much as small-scale gear which demonstrates processes we haven't dealt with before now. (6) Pedagogy – perhaps the most significant contribution of accredit-

ing teams – is going to be in this area. Audience response units in large auditoria, micro teaching, other micro work, the kind of internships I described above, team teaching, video tape and closed circuit TV and many other features of viable, modern, meaningful verbal learning situations will be evaluated. A replacement overhead projector won't be nearly as impressive as eight millimeter loops appropriately used in micro professional work or as resource people from area enterprises. (7) Content – evaluation teams will make careful analyses of the program, courses and units to assure that majors are getting contemporary (and historical stuff) and not outdated stuff. Much of what we teach was never important in the trades which our forebears looked at with a copy of an analysis text in their hip pockets. Accreditation teams will include people from the exact sciences and the behavioral sciences which study enterprise to assure that our programs are attuned to contemporary productive society. (8) Finally, evaluation teams will assess interdepartmental, campus, industry and community relationships. We have done little with this and have overemphasized the physical aspects of our programs. In future we will be much more concerned with evaluating our content, our pedagogy and our impact on the campus and beyond.

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CONTEMPORARY CONCEPTS IN EVALUATING TEACHER EDUCATION

Kenneth R. Clay

Whenever we speak of evaluation, the first question that co es to mind is, "Evaluation of what?" This causes us to focus on educational objectiv Regardless of whether they are departmental objectives, program objectives or co objectives, these objectives provide us with guidelines for evaluation.

We could probably all agree that the basic objective t of our programs of teacher education is to produce a successful teacher. Howe is kind of goal or objective is far too general to provide real meaning or dire for the development of evaluation techniques. Furthermore, as we all know, it is a l ly complex process and, as Dr. Stadt has indicated, must be evaluated before, imme ely after, and long after graduation. While I would strongly advocate the need for ex sive longitudinal studies, in order to evaluate the quality of our product, I would questi the immediate usefulness of such studies, since the time delay in obtaining the results is ather lengthy. Therefore, I will try to focus my remarks on kinds of techniques that perhaps will give us a little more immediate feedback on the success of our program and the evaluation of students as they proceed through our curricula.

Dr. Stadt has suggested two major areas of competency for industrial arts teachers: the subject matter competency and pedagogical competency. I think most of us would agree that these are two major areas in which our students must develop competency. However, unless we are more specific, it is still relatively difficult to develop evaluation techniques to provide us with objective information regarding the attainment of these competencies. What I am suggesting here is that we must analyze and break down our educational objectives into specific behavioral statements of the outcomes we desire. Some of the most significant research done in this area are the several taxonomies of educational objectives which have been developed by Krathwohl, Bloom and others. Their work has been based on a three-fold division of educational objectives:

"1. Cognitive: Objectives which emphasize remembering or reproducing something which has presumably been learned, as well as objectives which involve the solving of some intellectual task for which the individual has to determine the essential problem and then reorder given material or combine it with ideas, methods or procedures previously learned. Cognitive objectives vary from simple recall of material learned to highly original and creative ways of combining and synthesizing new ideas and materials....

"2. Affective: Objectives which emphasize a feeling tone, an emotion, or a degree of acceptance or rejection. Affective objectives vary from simple attention to selected

phenomena to complex but internally consistent qualities of character and conscience. . . .

"3. Psychomotor: Objectives which emphasize some muscular or motor skill, some manipulation of material and objects, or some act which requires a neuromuscular coordination."

They have found that objectives as stated by teachers, as well as those found in the literature, can be placed rather easily in one of these major domains or classifications. To date, as far as I know, they have developed taxonomies for both the cognitive and affective domains. It is my understanding that they plan to complete the psychomotor domain in the near future. It would appear that much of our current evaluation of student progress in industrial arts teacher education has focused on the cognitive domain, which largely centers on the acquisition of knowledge. Some of our performance tests, I'm sure, have assisted in evaluating certain psychomotor objectives which emphasize some muscular or motor skill. However, we have largely ignored the affective domain. These objectives are many times expressed as interests, attitudes, appreciations, values and emotional sets or biases. While all three of these areas are important in the evaluation of student progress, it would appear that when we focus on those traits or characteristics that produce a successful teacher, the affective domain area has particular significance.

As a taxonomy implies a classification system, not only have Bloom and Krathwohl developed three major domains of educational objectives, but they have further developed extensive classification systems within each of the domains that they have currently published. For instance, in the affective domain, objectives can be classified as:

(1) Receiving or awareness
(2) Responding
(3) Valuing
(4) Organization
(5) Characterization by a value or value complex.

If you have not had the opportunity to examine these publications, I would certainly recommend them highly if we are seriously interested in developing objective measures of the attainment of some of our objectives and goals which we hold.

With this as background information, I would like to spend the remaining portion of my time discussing some practical and, hopefully, useful techniques that may be of assistance as we evaluate our students' progress.

One of the most important challenges facing industrial arts teacher education in the future will be our ability to recognize varying backgrounds and experiences of individual students so that we may design modular programs based on an accurate assessment of skills and knowledge already acquired. No longer can we afford the luxury of developing a common curriculum for all students.

In order to develop such modular programs, it will be necessary to develop much more accurate techniques of evaluation. One of the areas in which students are most likely to have acquired previous background might be certain psychomotor skill development and its concomitant related knowledge. If we are going to assess this type of background accurately, it would appear that we must first identify various levels of desired competency. While generally we might say that minimum competencies would be sufficient, in this case we should have a fairly clear idea of other levels, so that we can design effective programs for students with a more varied previous background and experience.

Perhaps our best technique for assessing psychomotor skills and related knowledges is well-designed performance tests. Care must be exercised when designing performance tests to insure that they will produce a representative assessment of the various levels of competence which we are attempting to evaluate. Furthermore, they must be comprehensive enough to include broad knowledges and understandings that are related to various psychomotor skills.

In addition to the type of evaluation that I just suggested, there are several other areas to which we should direct increased attention throughout our teacher education programs. One of these is an assessment of the ability to think. Too often our quizzes, examinations and other evaluation techniques have focused on simple recall and acquisition of facts and knowledges. Instead, we must develop questions and evaluative techniques that cause the student to apply facts and knowledge to achieve correct answers or solutions to the questions raised. Even our objective multiple-choice questions can be designed so the correct responses require the application of knowledge to a particular situation.

Another important area where we must increase our attention on assessment is those

factors related to the development of critical thinking and problem-solving abilities. In the future, I feel that this will probably be one of the most critical areas of assessment. In fact, I think we are seeing even today the tremendous importance that these factors have on successful teaching.

Perhaps one of the best ways of assessing these abilities is to develop structured problems that can be solved by students. The structure and specification of the problem must vary according to the level of the student, time available and the desired outcome.

Another technique that we tend to shy away from is observation of students while they're performing classroom activities in both formal and informal situations. Opportunities are presented daily where students can be observed applying knowledge to problem situations, analyzing a particular problem and developing appropriate solutions.

In addition to assessment of subject matter competency, another major area in our field which always gives us great concern is determining growth in ability to teach, or as Dr. Stadt indicated, pedagogical prowess. It would also appear that in this area the affective domains which I have discussed earlier would have major implications on this type of competency. I'm sure that we recognize that a true assessment of this ability, or growth in attaining this ability, must be delayed until some point in time after graduation. However, we are constantly looking for ways of obtaining constant feedback throughout college teacher education programs.

A few of the major practices used in promoting growth in this area have been:

(1) Providing early observation of public school classes and teaching situations in an undergraduate program.

(2) Consideration of some aspects of teaching integrated into subject matter, content courses.

(3) Opportunity to have teaching experience within various college classes.

One promising technique of assessing the growth and development and effectiveness of such practices, while providing for continued development, I believe, is a kind of experience with which we are experimenting at Glassboro. We label this experience "a practicum in industrial arts teacher education." We are providing this experience during the second semester of the junior year. At this time our majors are enrolled in what effectively is labeled as a single course carrying 13 semester hours of credit for a full semester. You might think of it as a professional semester. This gives us tremendous advantages, since we have complete control of the student's time for one full semester. We are not concerned with other course schedules and having to work around them.

During this semester, we provide what we call "an integrated professional laboratory field experience." Our practicum has been structured to provide three types of learning experiences:

(1) Field experiences in the public school industrial arts programs at three levels including elementary, junior high school and senior high school.

(2) Observation and participation in several industrial or manufacturing industries.

(3) Study of content selection and implementation of industrial arts programs carried out through seminar sessions held on campus throughout the semester.

These seminar sessions provide us with the opportunity to integrate and build upon the field experiences that our students have with industrial situations and their public school experiences. Furthermore, we are able to develop and plan types of learning experiences which we can try out in the public schools, and the students can then, in the field experiences, experiment with some of these techniques and report the results immediately to a later seminar session.

This whole arrangement provides us with some ideal flexible scheduling arrangements. For instance, we can decide to have our students off-campus in field experiences on a concentrated basis for full days or even full weeks and then bring them onto the campus for concentrated seminar sessions, maybe lasting a week or so. Another arrangement is the possibility of intermittently having students participating in field experiences and back on campus for a day or two each week. The specific structure and schedule of the practicum experience are largely determined by the kinds of activities we're getting into and the demands or needs for time at a particular point in the experience. This experience provides us with an excellent situation in which we can make some rather specific assessments of the development our students have made of teaching competence. Furthermore, here is an opportunity for the student to answer the question in his own mind as to whether he has developed the necessary competencies to carry out his role as a teacher.

In summary then, I have indicated that we should:

(1) Examine our specific goals and objectives very closely, both program and in-

dividual course objectives, for direction in developing specific techniques and measures of evaluation.

(2) Utilize the work of Krathwohl, Bloom and others who have worked on developing taxonomies of educational objectives.

(3) Accurately assess previous background and experience and develop modular instructional programs.

(4) Exercise care in developing tests and other measures of evaluation in order to emphasize application of facts and knowledges which place a premium on critical thinking and problem-solving competencies.

(5) Place increased faith on our ability to make accurate assessments through observation techniques.

(6) And finally, one way of determining growth of our students in the acquisition of competencies related to successful teaching might be through an integrated professional laboratory experience such as I have described as our practicum experience.

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F-15.2 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS APPLIED TO THE SUPERVISION OF INDUSTRIAL ARTS
Chm., Ralph Steeb; Rec., Estell H. Curry; Speakers, Bryce D. March, Ollie Jensen; Reactors, Marshall Hurst, John Parr; Host, Eldon Brandt.

NATIONAL TESTING: AN OPPORTUNITY FOR INDUSTRIAL ARTS

Bryce D. March

National assessment received attention in the September, 1965, issue of the Phi Delta Kappan regarding the Exploratory Committee on the Assessment of the Progress of Education. Another treatment came in April, 1967, in an editorial entitled "Who Should Do the Assessing?" It would include paper and pencil tests, interviews and observations. It was stated:

> Since we place no limit on the authority of the classroom teacher, no matter how inexperienced, to assess, evaluate, grade and brand individuals, often with damaging comparisons, why is there such violent objection to an assessment prepared by experts?... We are collectively crazy if we continue to pour billions into education and do not attempt to measure the results.

An article in that same issue, "Assessing the Progress of Education", reported on the contractor, objectives, sub-objectives, description of sample activities or exercises and reviews. Objectives to be covered under "Vocational Education" include:

(1) Developing effective work habits.
(2) Deal with objects, problems, comments and symbols.
(3) Deal with people.
(4) Make a realistic career choice.
(5) Awareness of the consequence of career choice.
(6) Prepare for a career.
(7) Effectively locate and select an occupation.
(8) Plan for contingencies.
(9) Have knowledge concerning changing occupations.
(10) Possess knowledge and skill in a specific occupational field in the non-professional world of work.

Materials are to be reviewed by the American Vocational Association.

Other subject areas may have been and may now be upgraded by standardized testing. Are the nationally normed tests needed? Certainly they can provide the parameters which have significance. Appraisal of some type is an obvious necessity in most activities.

Stability has been claimed by several authorities as a possible result of more recorded testing. The guidance values include information which may contribute to assessing abilities and vocational interests. Recognition for a field of activity has usually followed interpretation of test results.

The improvement of instruction as a supervisory function is facilitated with normative data to contribute toward decision-making. Some type of national testing can precede or follow any nationally-accepted curriculum minimums.

Some of the respected men in our field say that national testing will not contribute to strengthen industrial arts. They say our strength is in our diversity and testing will not contribute to diversity.

Attempts have been made to make certain single tests applicable to the entire field of industrial arts. A copyrighted, unpublished set is entitled "Informational Achievement in Industrial Arts". It does have sub-parts.

One of our chief problems seems to be the concern with broad concepts and basic understandings and the body of subject matter for which the test is devised. "Standardized tests may seriously affect experimentation, exploration and versatility," according to another of today's spokesmen.

There is a "tendency to fix the curriculum because teachers teach what they test". Is this all good or all bad? Inasmuch as we have not "fixed" our curriculum any better than we have to date, how about backing into it?

We must follow objectives and the sub-objectives with the activities, experiments and concepts, which will need to be brought into sharp focus with frequent revisions. In fact, national assessment may force refinement and acceptance of the nationwide stated objectives.

We'll have difficulty measuring creativity. But observations have already been proposed in the first national testing effort. Perhaps these observations will help.

A problem on the Graduate Record Exam is no sub-part in industrial arts or vocational education. And there are other limitations. We are reminded that it is difficult to test safety attitudes, leadership and work attitudes. Clever testing can bring us greater returns here than we might have thought at first.

Some schools lack the necessary equipment. This may be the lever to get it. We can document over and over again how more generally accepted objectives can lead to broader acceptance of curriculum. We could have certain types of minimums for curriculum and therefore for equipment. Many state departments and other sources have listed suggested equipment for years. These lists may take on new meaning and significance. We can readily see how this could help many industrial arts instructors to assist the school officials to represent to boards of education who in turn have quantification and qualification of need to place before the public.

Assessment will favor schools with fully trained teachers – the others will feel more obliged to complete further training. Master's degrees should become more prevalent with this boost.

Federal programs suggest or require sufficient comparative measures for evaluation. This is done under Title I of the Elementary and Secondary Education Act.

The number of tests in other subjects with several apparently national norms totaled over 200 by a count in The Sixth Mental Measurements Yearbook by Buros, 1965. English, math and science have by far the greatest numbers.

Buros lists thirteen tests in industrial arts. Among them are:

IA Education-National Testing Exam (1947-62), Educational Testing Service

General Shop Work - Manchester, Semester-end Achievement Tests

Mechanical Drawing Test, State High School Tests for Indiana

Middleton Industrial Arts Test

IA Every-Pupil School Test-Bureau of Educational Measurements, Kansas State Teacher's College, Emporia

IA Teacher Education Exam Program - Educational Testing Service, Princeton, New Jersey

No research germane to our topic was recognized in the Review and Synthesis of Research in Industrial Arts, the Center for Research and Leadership Development in Vocational and Technical Education, the Ohio State University, Columbus. The publication lists in the bibliography:

March, Bryce D., Assessment of Informational Achievement in Industrial Arts (Copyrighted) Doctor's Thesis. Carbondale: Southern Illinois University, 1961
The abstract for this research indicates under "Purpose":
The purpose was to assess informational and problem-solving achievement in industrial arts mechanical drawing (including sketching, planning and designing), electricity, metalwork, and woodwork as listed by instructors and state courses of study. This achievement is commonly expressed by the phrase, "Things the Student Should Know". In order to measure this, a sufficiently valid and reliable instrument was developed and its effectiveness for comparative purposes determined.

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THE DEVELOPMENT AND EVALUATION OF ACHIEVEMENT TESTS

Ollie Jensen

According to the program notes, I am, under the general banner of "New Concepts in Evaluation", to talk specifically about the purpose, content and techniques of "National Standardized Testing". Exercising my rights, both as an amateur public speaker and as a professional test technician, I am hereby pulling down the "new concepts" banner and hoisting a less general, more mundane one. The flag now flying over this portion of your conference program is "well known but too infrequently exploited concepts in evaluation."

Having engineered a strategic withdrawal from the frontiers, I shall proceed to expand the field of specific activities to be encompassed. I shall talk about achievement testing – national and local, standardized and unstandardized, objective and subjective.

There is a series of national, standardized achievement tests for use in industrial arts classes being developed under the joint sponsorship of the American Industrial Arts Association and the Industrial Arts Division of the American Vocational Association. This project had its origin in July 1964 when representatives of AIAA and AVA met with test specialists from Educational Testing Service to explore the feasibility and wisdom of attempting to develop such standardized measures.

A progress report on the status of the tests being developed has just been written by Dr. Ben Shimberg, Director of Vocational-Technical Education Projects at ETS and will appear in the May issue of Industrial Arts and Vocational Education. In this report Dr. Shimberg discusses the development of the tests under such headings as "Study of Need," "Organizing Test Committees," "Planning the Tests," "Writing Test Questions," "Editing and Review," "Pretesting and Norming the Tests." Because of the ready availability of this report I shall confine my remarks on the project to an enumeration of the kinds of tests being developed and the main steps in the developmental timetable:

(1) The initial set of tests will be for use at the junior high school level.
(2) There will be separate tests for (a) general industrial arts, (b) industrial arts metals, (c) industrial arts woods, (d) industrial arts electricity/electronics, (e) industrial arts drawing.
(3) Two comparable forms of each test will be made available. There are 50 multiple-choice items in each test; each test has a 35-minute time limit.
(4) Four preliminary forms of each test are being pretested at the end of this month.
(5) This fall the two final forms of each test will be compiled on the basis of pretest results.
(6) The final forms will be administered in schools across the nation for norming purposes next spring.
(7) Hopefully, the tests will be on the market late in 1969 or early in 1970.

The foregoing enumeration of topic headings in Dr. Shimberg's progress report and of steps in the developmental timetable points up several differences between national standardized tests and teacher-made classroom tests. These differences can be summarized as follows: The standardized test, because of all the analytic and norming steps and the multiplicity of viewpoints incorporated into its development, can provide more

and more reliable categorical information than the typical classroom test. On the other hand, some or all of the information categories utilized by the standard test may not be related to a particular classroom situation. Also, because of the long developmental lead time for the standardized test, it is conceivable that some categories of information built into the standardized test could be obsolete before or soon after test publication.

In other words, the standardized test, similar to the classroom test, must be evaluated in terms of local, situationally appropriate, objectives. How does one go about evaluating standardized objective tests such as those in the forthcoming industrial arts series? I shall attempt to answer this question by asking and then answering a few more basic questions: What is an objective test? What is a test? For what purposes are tests used?

The purpose underlying the use of any test is the generation of a basis for making sound value judgments - about individuals, about groups, about procedures or methods, about programs, about institutions. A test does not make value judgments; it is merely an instrument for eliciting and measuring a selected sample of behaviors under standard conditions. A test score is a succinct description of the status of an individual on one or more behavioral dimensions. The degree to which a particular test measures behaviors and aspects of behavior related to your immediate classroom objectives must be determined by you, regardless of whether the test is standardized or homespun, subjective or objective.

The word "objective" refers to a single aspect of testing, namely to the scoring. Except for the intrusion of clerical errors, all scorers of objective tests will arrive at the same set of scores. The planning, construction and administration of objective tests is as subjective a process as the planning, construction and administration of any other test. Computer programmers have a saying that fits this situation well, "Garbage in, garbage out." Translation - test score output can be no better than the test planning, construction and administration input.

In each instance in which testing is contemplated, you must answer in detail the following questions:

(1) What is your purpose in testing? (a) Is it to diagnose individual strengths and weaknesses? If so, you will need intensive coverage of each content-ability facet selected for measurement. (b) Is your purpose the rank ordering of individuals in terms of overall performance on several kinds of tasks? If so, in light of the usual restrictions on available testing time, representative coverage of content-ability facets is generally more practical than is intensive coverage of each facet. (c) Is your purpose merely to compare groups of students in terms of average performances and variability of average performance? If so, test coverage must be representative of the selected domain, but it can be less intensive than in either of the foregoing instances.

(2) Which facets and elements of subject-matter do you want in the test sample? Are there facets or elements you want specifically to exclude?

(3) At what ability levels do you want to test? Are you interested in the retention of facts as such? Are you interested in relative achievement of a level of understanding which permits an individual to interrelate, compare and contrast selected factual material? Are you interested in differences in ability to apply factual knowledge and understandings of relationships to specifically defined situations?

(4) In terms of achieving representative coverage at desired levels of intensity, what weight should be given to each content-ability category within the test domain?

In the course of spelling out the answers to the preceding questions, you will be developing a set of test specifications. These specifications, defined in light of your immediate objectives, provide the basis for evaluating the appropriateness of a standardized test or the basis for constructing your own test. Without a set of test specifications you are in the same position as the building inspector or the construction contractor who attempts to do his job without a set of blueprints - your basis for evaluating a standardized test or constructing your own is mere intuition.

The building construction analogy reveals a major problem confronting teachers, curriculum supervisors and school administrators. In addition to all other duties, the teacher, supervisor or administrator is expected to be a test architect, a test constructor and a test inspector. The formal preparation for this multiple role offered by the typical academic institution is one miserable survey-type course in tests and measurements.

I should sit down now. Your plight is so sorry, your needs so great. What consola-

tion can I provide in the few minutes remaining? I should quit, but I won't. First, I shall point up the difficulties of developing useful sets of test specifications. Second, I shall describe in detail the item construction faults commonly found in teacher-made tests.

Two main difficulties are encountered in the development of adequate test specifications. Difficulty number one is that it involves work – painstaking, time-consuming work. Difficulty number two is that few procedural guides are available, and these few appear to be confusingly divergent. The apparent confusion stems from the fact that the existing guides are products of persons from differing disciplines; they were prepared for widely different test situations; and the few attempts at cross-referencing, either by discipline or situation, have been abortive.

There is nothing mysterious about writing test specifications. Specification writing is not unique to testing. It is basic to engineering, purchasing, construction and manufacturing operations. It is, in fact, a necessary part of any complex enterprise in which it is important to minimize the opportunity for error or the consequence of error.

Most teachers either forego the luxury of written test specifications or write very general ones. Either course can lead to disaster. Either can result in gaps in coverage, improper weighting of objectives, inclusion of overlapping or duplicate questions, and use of questions which give away or point up the answers to other questions.

After perusal of a set of blueprints, a contractor should know in detail the size of and the quality of construction in each room of a house, and he should be able to build the house with minimal errors of omission or commission. Similarly, anyone with journeyman-level test construction skills and subject-matter knowledge, after development or perusal of a set of test specifications, should know in detail the scope, character and quality of the test in question and should be able to build or evaluate a finished product with minimal errors of omission or commission.

The following set of test specifications, regrettably, is not a "straw-man" set up for the spec[illegible] of being knocked down. I quote:

> T[illegible] posed of 75 multiple-choice questions and contains 10 questions [illegible] planning, 10 questions on safety, 15 questions on tools and ma-[illegible]ns on materials, 15 questions [illegible] processes and 10 questions on [illegible] and consumer information.

What can be said with specificity about the product resulting from application of the above set of specifications? One can presume, from the breadth of topics covered and the meaning of topic titles, that the test probably is to be the written portion of a final examination for some kind of course in industrial arts or vocational-technical education. But in which field? Woods? Metals? Carpentry? Welding? Auto Mechanics? Air Conditioning and Refrigeration? At what level? Junior high? High school? Junior college? Beginning course or advanced course? Within any one of the content categories listed, what levels of ability are to be tested? Is the answer to each question to be obtained from an automatic regurgitation of imbibed facts? Or are the correct answers to be found only through systematic selection, interpretation and application of facts?

To pin-point the answers to these and related questions, the content categories must be refined and ability categories must be set up.

It is unfair to evaluate the specifications for a final examination out of context. Generally, specifications for a final examination represent implicit or explicit selections from and modifications and generalizations of previously developed specifications for the more intensive but less extensive unit and lesson tests.

The lesson test (or the teaching aid or study motivating or programmed-learning unit-test) is the bottom rung of the testing ladder. This is the test which redundantly covers every point to be learned in one sitting or a single lesson. Here, breadth of coverage is limited; often only a single aspect of a single topic is covered. On the other hand, each element and relationship in that aspect is tested, often repeatedly. For example, in the programmed learning approach, there is immediate diagnosis and feedback after each question. If the student answers the question correctly, the diagnosis "you know enough to proceed" is fed back. If the student answers the question incorrectly, the feedback is, "Review X and Y before attempting to answer this question a second time."

Specification writing for the lesson test is semi-automatic. The specifications for the lesson test are literally the lesson. The real test planning took place when it was decided what the lesson would include and how it was to be presented. Here too, item writing is almost automatic. Each point in the lesson is to be tested. The detail in the learning situation presentation spells out the elements and relationships to be used and the method of lesson presentation suggests the ability level to be tapped in any given question.

Development of adequate specifications for a mid-term or final examination can most easily be accomplished through explicit successive, representative sampling of specifications for lesson and unit tests and through making the consolidations and extrapolations of these specifications needed to cover the generalizations from early specific learnings that course objectives dictate should be inculcated and tested.

In summary, development and application of adequate test specifications represent the only known systematic approach to test construction and evaluation. The specifications for the several kinds of tests used in a course should be conceived and developed as integrated parts of an overall program. Proper execution of a test specification development program, like the execution of any systematic problem-solving program, involves work – painstaking, time-consuming work. The choice is clear: It is high-grade in, high-grade out or garbage in, garbage out.

In the course of the eighteen-plus years that I have been a test technician, I have reviewed over a thousand objective tests prepared by teachers for one purpose or another. Two contrasting item faults characterize these tests. These construction errors are not readily recognized by the teacher making them because it is seldom that either alone is present and the combination generally affects a rank ordering of students by test score that reinforces commonly-held stereotypes concerning students and written tests.

First, teacher-made items tend to contain clues which allow the verbally bright and test-wise to answer them correctly without knowledge of the subject-matter involved. Second, teacher-made items tend to contain ambiguities which confuse the more subject-matter knowledgeable students by making one or more of the intended wrong answers as plausible as the key answer. The net effect of this combination is spuriously to raise the test scores of bright, test-wise students and spuriously to lower the test scores of the knowledgeable but non-verbal and non-test-wise students. The resulting distribution of test scores, however, contains no surprises. At the top are those bright individuals who get good grades in most of their classes. At the bottom are those who get poor grades because they never try and those who get poor grades because they never learn regardless of how hard they try. Mixed in the middle are (1) the apparently mediocre, (2) those irksome people who are always raising pertinent questions in class and who always seem to go out of their way to miss test items and then attempt to justify their mistakes by arguing the plausibility of the answers they picked, and (3) the poor souls – the individuals repeatedly characterized as having a high level of knowledge in their hands but no knowledge that will show on a paper and pencil test.

In the typical 50-item, teacher-made, multiple-choice test, the verbally bright student can pick out the intended correct answers to a half dozen or more questions through exercising his above-average vocabulary and applying a little general reasoning. The test-wise individual can, also, receive a gift of a half-dozen or so correct answers through utilizing his knowledge of teacher likes and dislikes in interpreting the differences in tenor and tone apparent in the item choices. On the other hand, the more-knowledgeable student, who is neither test-wise nor highly verbal, can pass by the key answers for a half-dozen to a dozen questions because the non-subject-matter clues are meaningless to him and because loose statements of problems and choices allow not only reasonable but often astute interpretations and applications to be made that the item writer either intended to exclude or did not even consider.

There are no new evaluation concepts, no new techniques for generating instant test constructors or test evaluators. There still is no substitute for systematic, timely thought coupled with hard, careful work.

In thirty minutes, one can only point up needs. Administration of the indicated re-education and training cannot be completed in a few minutes or a few hours. For example, when I was in the business of training civil service examiners, the timetable for training was about as follows:

> From the time I snatched the prospect from the collegiate womb and slapped him across the backsides with a practicum in the realities of the world of work and stuffed a nursing bottle full of formal courses in test and item construction in his mouth – to the time he was housebroken to an extent that the value of his contributions matched the costs of cleaning up the messes he made – six to nine months had elapsed. Those surviving the perils of infancy generally needed an additional eighteen months to two years of on-the-job training before they achieved the breadth and depth of skill characteristic of the beginning journeyman.

The overall moral of my sad tale is that the purpose and content of, and the techniques used in constructing, norming and validating a national standardized test should be stated

by the publisher in the test manual. And the evaluation of stated purposes, content and techniques is best achieved by viewing all through an eye jaundiced from detailed knowledge – detailed knowledge of the technical do's and don'ts and of your own particular set of institutional needs.

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F-15.3 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN ELEMENTARY SCHOOL INDUSTRIAL ARTS
Chm., Paul Kuwik; Rec., Arthur J. Rosser; Speakers, D. D. Nothdurft, Walter J. Hall, Melvin Klemme, Bert Greene; Host, Stanley Turner.

SOCIAL DEVELOPMENT OF CHILDREN

Walter J. Hall

Today, we are faced with a fundamental and difficult problem: acculturation, a problem which challenges skills of much more sophisticated minds than mine. Few here would disagree with Eli Ginzberg's statement of what we expect education to do. He writes:

> We expect it to narrow the gap between the individual and society. We expect it to shorten the distance between individual capacity and collective needs. We expect it to be helpful in creating constructive attitudes – both on an individual and group basis. We expect it to impart basic and essential general knowledge for rounded living and basic and essential specialized knowledge for specific careers. We expect it to develop ethical values. In short, we expect [illegible]tion to furnish the individual with the necessary intellectual, s[illegible]ch-nical clothing for a presentable appearance in the world c[illegible]

Yet we know that the subculture to which the American caste system has assigned some children tends to give a peculiar twist to the normal cultural conflict that accompanies the realization of these ends in the American school. Certain cultural conflicts according to Mercer, are at the center of the life of the school. He avers that these conflicts are of two sorts: Those which arise from the peculiar function of the school in the process of cultural diffusion and those which arise between teachers and students because teachers represent the culture of the wider group and because students are impregnated with the culture of the local community.(2) At this point, it seems important to consider some broad objectives of education, especially as these relate to the child as he moves through the school and the attendant process of social development:

(1) To aid each child to achieve self-realization.
(2) To aid each child to develop satisfying human relationships.
(3) To aid each child to achieve economic efficiency.
(4) To aid each child to develop attitudes of civic responsibility.

We may assume that the goal of each student is to achieve self-realization; we may then further assume that all other educational objectives become subordinate. When the school provides a curriculum that makes ample provision for the student to develop satisfying human relationships, to secure skills that will enable him to achieve economic efficiency and to participate in situations designed to develop positive attitudes toward civic responsibility, then the framework for the achievement of self-realization is structured.

Social adjustment in the school environment and academic success seem to be so closely related to self-realization that any attempted division could be dangerous and subversive. Numerous studies of student achievement and adjustment have indicated that no longer may educators assume that student failure and discipline problems are the

lirect result of limited mental capacity. On the contrary, especially where disadvantaged :hildren are concerned, these same studies often point to a variety of physiological, psychological and sociological factors that contribute to "measurable" low intelligence scores so often revealed in mass school testing. Here, the school and the curriculum design are important to the child's potential development.

Pupil-centered curriculum can be vital in helping the student to achieve self-realization, for flexibility and variety in the courses of study and especially in resource materials can provide opportunities for the student to adapt more readily to school life; however, subject-matter-oriented teachers may be unable or unwilling to make wise use of the latitude of the pupil-centered approach. Such a situation may lead to pupil frustrations and create hot-beds of potential behavior explosions. May we be reminded again that the fact that a student does not get along well in school, that he fails to read as well as other children in a group, that he plays truant or that he is a troublemaker, is not conclusive proof of limited mental capacity. Malnutrition, poor health, emotional tension, trouble with parents or brothers and sisters, poor eyesight or hearing, meager educational resources at home – these are only a few reasons, other than limited intellectual capacity, why children fail to meet expectations. One should never assume, as some teachers are wont to do, that educational backwardness is due to intellectual limitations, until all other possible causes have been explained and attempts have been made to remove them. The teacher may be wise to assume at first that the cause of failure is some factor or factors in the instructional program that can be controlled or changed, or some condition in the pupil's physical, social, economic or cultural environment that can be improved.

All this requires, of course, that the teacher become acquainted with the home and neighborhood environment in which the student lives and learns. Tension and conflict in the home, arising from many cases – poverty, ignorance, maladjusted parents, lack of control or too much of it, and many other problems – may contribute to difficulty in school, both in learning and in social adjustment. A vicious, unwholesome, unstimulating neighborhood, without playgrounds, libraries or other recreational resources, may handicap the school. Every reasonable effort should be made to improve the environmental circumstances.

In addition to the environment, the teacher must consider the results of conferences with other persons involved: The counselor, attendance officer, other teachers, school office as well as the anecdotal and cumulative records and results of standardized tests, in order to ascertain the grouping of students.

The social and civic development of the child should begin in the home and should be a continuous process all through his education in the classroom. The child's social development seems to be influenced by his physiological development and general intelligence as well as by his experience with people. For example, experience courses, social planning courses, vocational planning guidance, and the "doing" courses such as elementary industrial arts offer special situations. Also there are the appreciation courses in the fine arts such as music, art and language. Aptitude test, standardized test of achievement, teachers' test and report interest inventories, personality test and other media can help aid the student to understand himself better, provided that these are interpreted to him objectively.

Some emphasis should be placed upon the values of leadership, citizenship, character, honesty and morals in all avenues of school life, and in such a manner that the students may be able to weigh for themselves their needs in these matters. To achieve satisfactory human relationship, there needs to be an understanding of how emotions influence lives, opinions, decisions and behavior. Emotional, social, intellectual and physical developments are so interwoven that maladjustment in one area will be manifested in another. Patience and good humor are two characteristics pupils, teachers and administrators alike can cultivate. To be accepted for what they are and helped to make the most of the best they have to offer would undoubtedly be the goal to attain.

FOOTNOTES

1. Eli Ginzberg, The Nation's Children (New York: Columbia University Press, 1960), p. 218.
2. Blaine E. Mercer and Edwin R. Carr, Education and the Social Order (New York: Rhinehart and Company, Inc., 1957), pp. 21-22.

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SUBJECTIVE CONCEPT: EVALUATION

Melvin E. Klemme

Attitude, citizenship, cooperating, attendance and improvement are areas that should be used for evaluation.

The areas mentioned can be expanded to cover a multitude of purposes for evaluation. Industrial arts must show the way to an end that a subjective scale for evaluation can be successfully implemented into education.

The purpose here is not to disregard formal methods of evaluation – written test, manipulative skill test, project requirements and others – the intent is to being to the surface evaluation of points just as important as the traditional methods. No program need be watered down; no student, parent or administrator need be pampered. Attention to individual students is important, especially in all innercity elementary schools of metropolitan areas since problems in all areas are quite similar. The main concern is the child, his growth and development, and unbiased, equal evaluation of all his efforts to succeed.

We are now confronted with classes that far outnumber justifiable size. This really makes little difference when the aforementioned criteria are applied with a level head by experienced and well-trained personnel, teacher and administrator. A cooperative community is very important no matter in what section of the city or country. This subjective scale under the above conditions for evaluation can be made operative. No matter how complex or simple the scale, there should be one used. It is hard and sometimes seemingly impossible, but never impractical.

The big problem to overcome in subjective evaluation is communication. A big downfall in all facets of education is the failure to communicate with the people involved: students, our future citizens. There needs to be a real two-way means of communication, not pseudo, but positive, between teacher and student. Once this is accomplished to the highest degree, then the subjective evaluation becomes an important tool. Please make no mistake, I am not speaking of "teachers' pets", straw-boss type individuals, but, instead, of good honest effort on the part of all parties involved, especially from the person who stands to benefit: the student.

When there are standards for evaluation set up based on the five mentioned factors, and made clear to the student in understandable language, the attitude, citizenship, cooperation, attendance and improvement criteria will work with application and common sense knowledge.

Expanding each criterion of evaluation, starting with attitude, we must agree that the task of teaching is much enlightened and improved when the student has a feeling of belonging, knowing there is someone interested in his or her welfare and willing to listen and understand his problems. Having worked with these evaluation factors for some seven years, in an inner-city school, my conclusion is that the attitude of the student is the foremost factor at this socio-economic level. With this in mind we can build a better student.

The next three levels of evaluation, citizenship, cooperation and attendance, are important and we have found no exact chronological order. As always there must be a next step.

Let's examine the evaluation possibilities of citizenship. This is something all students want to possess. Regardless of how the student acts, in the final analysis the desire on his part is to be a member in a society in which he is considered a good citizen. How then must we help endow the student? Stress responsibility, respect for law and order, obedience to regulations, knowledge of right from wrong. There are many more, but these are just a few.

From here we move to the cooperation element of the evaluation concept. Everyone who will read this concept knows the importance of cooperation. If all people and nations did justice to the cooperation aspect of living, think how much less trouble there would be in this world. Educators can, if they will, stress this factor in the laboratory, classroom, hallways, athletic contests and playground work every day of the student's school life. Evaluation can be made positive or negative. This is left up to the discretion of the teacher. With experience, common sense and knowledge, there should be no problem!

All of us have read about the problems of business and industry as to the attendance rates and losses suffered as the results of employees' time lost. Good attendance

records should be stressed, and when they are accomplished, the students should be given - lit. There is no better place than in our educational program to stress the attendance factor if you are going to accomplish a goal. We must give recognition for this accomplishment. If we can instill in the student a pride in being on the job every day, our whole picture, over a period of years, would change. We are all making records, whether they be negative or positive. We would like the positive factor to be the predominant one on the record, and with continued effort, all persons involved will benefit.

The main purpose of the learning processes is to improve one's position in relation to others. Here we have the improvement evaluation factor. When a student has tried to meet the other four factors, then with a little effort, he is bound to show signs of improvement. As we all know, you get out of anything just what you put into it. Then it stands to reason that the more the student, teacher and administrator try, the more will be accomplished. There are those who will say that some people do not want to improve, but these people have probably started badly and no one has bothered to try to help them help themselves.

Improvement must be a factor in evaluating a person in the highly subjective type of evaluation criteria being suggested. The problem with all the criteria and their usage is in being able to communicate with the student, at the student's level, and then using the evaluation criteria to give students greater values to work towards, besides a cold hard grade of a test.

Mr. Klemme is Industrial Arts Teacher in Indianapolis, Indiar

F-15.4 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN METALS
Chm., John R. Ballard; Rec., Albert Squibb; Speakers, Ronnald C. Lemar, Thomas Tsuji, David Matthews; Host, Bob L. Agnew.

STUDENT EVALUATION IN METALS COURSES

Thomas Tsuji

If the purpose of this meeting would be (1) that of determining value of recent innovations in the field of applied metallurgy or (2) that of discussing the merits of current measurement methods of fabricated metal parts, then the discussion topic to follow would be rather simple to develop. However, the charge of this particular meeting is that of attacking the problem of evaluation of students as related to the teaching of metals.

Evaluation of students in industrial arts classes has traditionally been made on the basis of achievement on performance of psychomotor skills. A generation of metals teachers has implanted the mark of success and failure of students using the criterion of workmanship or some similar skill. Further, some teachers of that generation claimed that evaluation of student progress via measurement of projects would result in the indirect measurement of cognitive learnings and that the causation of learning was somehow related to doing. Such assertions are viewed with suspicion today.

The trend in the area of metals seems to be that in which the content of the courses is including activities stressing knowledge and requiring the learning of cognitive skills. Hence, it is not unreasonable to assume that measurement of student achievement will include a greater emphasis in valuing learning which may be classified as cognitive elements. This does not mean that psycho-motor and affective growth of students will not be measured; more precisely, the emphasis will be switched to the cognitive area with a proportionate drop in the other two areas. No longer will evaluation be based on 10% citizenship, 10% classroom work and 80% project.

The emphasis on the cognitive area of knowledge in metals ought not to be taken lightly.

Those who view activity by manipulation as the major objective of learning will find in creasing criticism from the rest of the academic world. The great strides made by th philosophers of science have necessitated a re-orientation of viewing knowledge and th application of scientific findings. The developments made by modern logicians, physica scientists and social scientists have made readjustment necessary for those educator in the fields of the applied sciences.

Evaluation in education will increasingly be related in terms of economic potential The huge commitment of funds to the educative process is now being followed by the de mand for accountability of our actions. The growth of knowledge in the past few years coupled with the developments in hardware to account for particular objectives, has in directly forced the enterprise of industrial arts to move in the direction of developin curricula based on cognitive knowledges. Thus, the recent curriculum projects emplo terminology and techniques which are easily identified with the machine (computer) an project the impression of being logical and relevant in terms of evaluation.

The evaluation of the student based on cognitive criteria has been facilitated by th availability of carefully documented materials concerning (1) taxonomies of cognitiv behavior and (2) techniques in the development of behavioral objectives. Both psycho motor and affective objectives are not being stressed as much as the cognitive area a the moment because the confirmation processes are not well developed for the two areas

At the operational level of the public schools the evaluation process of students wi not change drastically in industrial arts until further developments are made in the are of curriculum. The various curriculum projects that are now being formulated and pro posed may in the future result in a defensible approach of industrial arts as a study whic American children ought to pursue. Psychomotor skills will in the future be less domi nant an objective of industrial arts; and finally, it is hypothesized that in the next fe decades efforts in evaluation will focus on the development of self-esteem in all students It is in the area of the emotive domain where teachers have been least effective in th education and evaluation of students.

Dr. Tsuji is Assistant Professor at Stout State University, Menomonie, Wisconsin.

LET'S UPDATE OUR EVALUATION METHODS

David E. Matthew

I have some suggestions that I hope will, at least, stimulate your thinking about you own methods of evaluation. The main obstacle to developing more sophisticated method of grading is lack of time. None of us likes to develop evaluation techniques that ar going to rob us of time needed for instruction or shop maintenance. Industrial art teaching is time-consuming as we all know.

We do need something more than a letter grade to show student progress in meta working. We demand equal stature with our academic departments of the school, an therefore we must show good reason why we deserve that stature. In the State of Iowa the Iowa Test of Educational Development is used to measure learning and improvement but it does not include questions concerning industrial arts subjects. The results of thi test are sent to teachers to use in counseling with students and parents. This is only on of many examples showing the emphasis on the "academic" courses in our schools Most schools today have very elaborate records showing academic achievement, bu industrial arts records are noted with a single letter grade. There still seems to b some stigma attached to our area. We must take the initiative and develop new and mor meaningful methods of evaluating our student progress in metal working.

Those who consider themselves academicians are reluctant to recognize us as thei equals. They know we're necessary to the school but we just aren't quite up to thei level. We must up-grade our evaluation methods and prove that we do grade more tha just projects.

First let's find out where we want to go and what we wish to accomplish with ou evaluations. The objectives I have selected may not coincide with yours but they wi do for an example. They are as follows:

(1) Student's grades. The student wants to know how he is to be graded, how well h is doing, etc.

(2) School records. We would like to provide the school with more elaborate records.
(3) Instructor's records. The instructor would like to have a record of how he arrived at the student's grade.
(4) Prospective or new employer. We would like to provide the employer with separate grades to place the student better.
(5) Military placement. These same records could aid in better placement when entering the service.

We now have some idea as to what we want to do. Let's select some methods that will help us to fulfill these goals.

Student profiles are not new but little used in the industrial arts areas. A profile card could show all the things we wish to measure in our metal working classes. It should be simple in design and simple to use. This is, I believe, absolutely necessary to make this card practical. Remember, these ideas may be altered to meet your specific requirements. The five areas to be graded are: Quality, quantity, tests, paperwork and attitude. I would place these across the top of the card and then I would allow percentages for each area so that they would total 100%. For simplicity I have placed equal value on each area. On the left side of the card I would number from the bottom by five's to twenty percent at the top. If the student has earned a perfect grade in quality of projects, place a mark at 20% under quality. If the student has earned a 15% under quantity then place a mark at that level under quantity. You plot the remaining areas in the same manner. When complete you have a profile of that student's performance in your class. Isn't this better than the same total grade but without any explanation of how the grade was designated?

Grading shop work can be rather haphazard. How do you evaluate your shop work? Do you watch each student every day and arrive at a grade for the day? Do you guess at some sort of a grade that seems to fit the quality of work he usually turns out? If you grade according to this last method, then it's possible for a sharp student to do his work, goof off and still earn an "A" grade!

I would suggest that one day each week be used for grading shop work, and every week it should be changed so that the students don't get wise to your method. The day selected should always be done in advance. Never select a day because students seem to be restless or unusually lazy. This method should not be used to "get even" with the students. You are looking for a way to evaluate shop conduct, work procedures and how well students work with one another.

Self-evaluation helps the student to develop some honest appraisal of himself. If you use a grading sheet for each project, include a place for the student to put down his own grade for that project. Most students are quite honest and, in fact, tend to underrate their own projects. Self-evaluation trains the student to develop a critical eye and a sense of pride in quality work.

Evaluating each other is another method that can be utilized if it isn't used too much. This should be controlled and be introduced as a form of constructive criticism. Another form of this has been used in college, but a demonstration is performed by one student for another. The student demonstrating provides a copy of the points he intends to cover to his one-man audience. His evaluator must grade his demonstration, and the instructor must grade both students.

The last suggestion I have for your consideration is the self-scoring test. How often does a test lose its importance because the corrected material was returned so late the student forgot what the test was all about? A method that has been tried employed the use of chemically-treated answer sheets. If the correct answer was selected, the special pencil used created one particular color; if the wrong answer was marked, it turned another color. This method made it possible for the student to select until he had the correct answer. The instructor could also tell how many attempts were made.

-15.6 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN DESIGN AND DRAFTING
Chm., Albert G. Mudgett; Rec., Gordon Gavin; Speakers, Charles E. Keseman, Bill Burns, William D. Umthor; Host, Vernon J. Bauer.

DOES THE EVALUATION APPROACH AFFECT DRAFTING ACHIEVEMENT?

Charles E. Kesema

Should the process of student evaluation serve only to diagnose past student perform ance or can it concurrently increase student achievement? Most of us would prefer t use evaluation approaches which simultaneously diagnose progress and increase achieve ment if we had these multi-purpose approaches identified.

In an attempt to identify approaches to evaluation which both diagnose and teach, have recently completed a dissertation study at the University of Missouri, Columbia comparing three approaches to the evaluation of college-level drafting assignments, an I would like to share some of the findings with you.

The study, entitled "A Comparison of the Effect of Three Evaluation Approache Upon Student Achievement in College Level Drafting," was conducted as a controlled ex periment involving three groups of students enrolled in IA&T 11-10 Fundamentals c Drafting at Central Missouri State College, Warrensburg.

The problem which led to this investigation was that various approaches to the evalu ation of laboratory assignments have been used by drafting instructors, but there wa lack of evidence indicating which approach was superior. Many instructors spend muc time evaluating nearly all laboratory assignments. Others contend that evaluation c sample assignments is equally effective in securing an accurate appraisal as well as i the motivation of student achievement. Another group states that if students evaluat their own work, achievement will be improved. Research evidence was inadequate wit regard to the optimum amount of time to be used by the instructor in evaluating drawin assignments and to the effectiveness of student evaluation as compared to various amount of instructor evaluation in drawing.

The purpose of this study was to ascertain the relative effect of "student self evaluation", "instructor-selective evaluation", and "instructor total evaluation" c college-level drafting assignments upon student achievement. More specifically, th study was designed to ascertain the extent to which the approaches used in evaluatin drafting assignments affected (1) informational achievement in college drafting; (2) draft ing skill in college drafting; (3) attitude toward the course in college drafting; (4) amoun of time required by students to complete drafting assignments; (5) amount of time re quired by the instructor for evaluating drafting assignments; (6) student ability to predic the laboratory grade for the course; and (7) informational achievement, drafting skill attitude and time to complete assignments for high- and low-ability students.

In this three-group controlled experiment, each group consisted of two sections c the IA&T 11-10 Fundamentals of Drafting course, scheduled during the fall and winte terms 1966-67. A total of 149 students was included in the analysis of results. The pro cedure followed during each of the two terms was to pretest the randomized groups, appl the treatment, and post-test to ascertain the effect of the treatment. Since the initia groups were found to be randomly assigned with respect to six control variables, analysi of variance was utilized in testing the null hypotheses. The control variables wer scholastic aptitude, informational achievement, semesters of high school drafting, attitud toward the drafting course, age and sex.

Each of the forty-eight students in the "student self-evaluation" group evaluate each drafting assignment by comparing his work with a projected transparency solutio and recording his evaluation on a rating scale for that assignment. In the "instructo selective evaluation" approach, twenty-five percent of the assignments in each of th six major units of the course were selected for evaluation. The work of the forty-si students on the selected assignments was evaluated by the instructor, and the completio of the remaining assignments was recorded. All assignments completed by the fifty-fiv students in the "instructor total evaluation" approach were evaluated by the instructor

In order to provide uniformity of instruction for the investigation, the following fac tors were held constant for all groups: instructor, laboratory room, textbook, writte laboratory assignment instructions, daily topic and assignment schedule, course outline length of class period, detailed lecture notes and correlated overhead projectuals, an morning class period. In accordance with the open laboratory policy of the Industria Arts and Technology Department at CMS, each student in all three groups daily set asid

ıboratory time necessary to complete his assignments outside of the class period.

The principal conclusions of the investigation were that all three approaches to evalation resulted in considerable gain in informational achievement; however, the study iiled to produce a significantly superior approach for advancing informational achieveıent or for developing drafting skill. Students showed little change in attitude toward rafting during the course regardless of the evaluative approach used. Each approach roduced a positive attitude toward drafting and none was clearly superior.

Students evaluating their own assignments completed their assignments significantly ıster than students with assignments evaluated by the instructor. The "student selfvaluation" approach takes considerably less instructor evaluation time per student than ıe "instructor selective evaluation" approach, which takes less time per student than ıe "instructor total evaluation" approach.

Students with assignments evaluated by the "instructor selective evaluation" aproach are more inconsistent in predicting final laboratory grades than students in the ther groups. Since data gathered from the high- and low-ability sub-groups were conistent with those from the total research population, it appears that none of the approaches s more effective for high- or low-ability students.

Since the informational achievement, the skill development and the attitude toward ıe course were not significantly affected by the approach to evaluation, since the "student elf-evaluation" approach required less time of both the student and the instructor to roduce similar results, and since students were equally able to predict their final ıboratory grade, the "student self-evaluation" approach is judged to be superior to the ther two approaches presented in this investigation.

r. Keseman is Assistant Professor at Central Missouri State College, Warrensburg, Missouri.

IS RETENTION AFFECTED BY ABILITY LEVEL?

William Edward Burns

This study was undertaken to investigate the effectiveness of retention of meaningful ıapping principles, facts and terminology in terms of initial learning and retention with arying levels of achievers measured through test questions designed for the categories f (a) knowledge, (b) translation and (c) interpretation as defined in Benjamin Bloom's axonomy of Educational Objectives.

A "levels x time" analysis of variance factorial design and Duncan's Multiple Range est were employed in this experiment. Subjects consisted of those students assigned by chool counselors for instruction in industrial arts mechanical drawing classes at Montomery Blair High School, Silver Spring, Maryland. The seventy-eight students included howed a mean IQ of 113.6 and a standard deviation of 12.95.

Four advanced drawing classes were included in this study. Three of these were esignated as the experimental groups and were provided with one hour of instruction per ay for twelve school days and then administered a criterion test instrument at three elected intervals during a thirteen-week period. The fourth class was the control group nd received no instruction, but was subjected to the same criterion test instrument that ıe experimental group completed.

Both experimental and control groups were further separated into three ability level roups. IQ scores were used as a basis for selecting subjects for these subgroups. Each f the three ability level groups consisted of twenty subjects in each experimental cell nd six subjects in each control cell. The experimental and control groups and each of the elected ability level subgroups were further statistically equated in terms of chronoogical age, academic years and prior drawing experience.

The acquisition of selected principles and facts relating to mapping and the mapping ıdustry were chosen as the learning task. Instruction was presented orally, supplemented y training aids, sketching, discussion and reading assignments.

One criterion test was used throughout the experiment. Groups were tested at the ompletion of the unit of instruction, and fifteen days and thirteen weeks later. The three

classes selected for the experimental population contained each of the three ability leve subgroups in approximately equal numbers. The test was an objective, multiple-choic type with four possible responses for each item. This ninety-item test consisted c thirty items designed to measure each of the Taxonomy categories of knowledge, trans lation and interpretation.

The findings of this study indicate that all instructed groups were superior to a non-instructed groups on the total test and each of the three subtests for initial learnin and at the fifteen-day and thirteen-week intervals. The higher the ability level of the ex perimental subjects, the higher were the test scores attained. There was no evidenc of interaction between the mental ability groups and the criterion test classifications a any of the three test intervals.

All three instructed ability groups attained the highest scores on subtest translatic at each testing interval. These groups attained approximately equal scores for subtest knowledge and interpretation. Each of the three ability level groups exhibited the remi niscence effect at different times during the experiment.

The following conclusions were drawn from this study: (a) the higher the ability leve of an instructed group, the greater is the retention level for selected facts and principle relating to mapping; (b) the type of mental skill required to answer a test question and th time since instruction may be factors in determining retention; (c) generally, there is progressive decrease in retention as the time since instruction increases; (d) subject are able to translate data relating to mapping better than they can recall factual knowl edge or interpret these prior learnings; and (e) subjects are able to retain a high per centage of their learnings for at least thirteen weeks.

Dr. Burns is Professor of Industrial Arts at State University College, Buffalo, New York.

IS THERE MERIT IN A PASS-FAIL GRADING SYSTEM?

William D. Amtho

In this brief time period, I will attempt to relate to you one concept of an A-F (pass fail) grading system which I am using in a descriptive geometry learning situation, som of the rationale developed in selecting this system, student reactions to the system, ar the results of a classroom research study.

When new issues of professional and trade journals appear on our desks we can b quite certain that they will contain some mention of a grading system. Upon reading w soon become aware that there exists a chaotic diversity in standards of grading practice; and that there is evidence that many educators are becoming more concerned about th grading process and its effects on students.

Evidence gathered from reading and teaching has convinced me that students are i duced to seek the wrong goals, to be satisfied when their performance reaches a give level rather than when they have done their best. If this is true, then the marking syste is damaging in its impact on the education of students and should possibly be abandone

Almost daily our mass communication media tell our youth to stay in school unt they graduate and suggest that diplomas are worth many thousands of dollars in lifetim earning power. This, of course, once again places emphasis on grades for graduation' sake and not on developing a depth of understanding or the ability to perform favorably i our society. Rather than handing out diplomas and suggesting that these are the keys t success, it seems to me that a requirement of a satisfactory measure of skill and knowl edge are more appropriate and realistic keys to future success.

In recent studies, two trends are in fairly broad agreement. First, fewer grade dis tinctions are being recognized. This eliminates the high degree of accuracy not prese yet suggested by numerous grade distinctions. It also minimizes some of the pressure on grades. Secondly, steps are being taken to reduce the great emphasis placed upo grades and grade-point averages. This helps to free both the student and the instructo to concentrate on understanding the subject matter.

At this time I wish to present a summary of an evaluation system which place

emphasis where I believe it should be: on understanding subject matter.

During the first semester of 1966-67, sixty-eight undergraduate students elected to enroll in the descriptive geometry course at Stout State University and became a control group for a two-semester classroom study. The class met in the conventional manner; three one-hour lectures per week, open laboratory work periods with assistance for solving assigned problems, and appropriate performance testing. The conventional method of grading on an "A-B-C-D-F" basis was employed. At the close of the semester the sixty-eight grades were distributed as follows: eleven A's, eighteen B's, twenty-four C's, nine D's and two F's. Four students withdrew from the course without being assessed credits attempted.

The second-semester descriptive geometry class was considered the experimental group for the study. It consisted of thirty-two members having the same schedule for lectures, for individual assignment work and for unit testing as the control group. The lecture presentations were equal to those in the control group, considering the same instructor covered the material using the same teaching methods, visual aids, equipment and classrooms. The control group and experimental group were assumed to be equal in ability and interest, since all members of each group met the prerequisite for the course and chose descriptive geometry as an elective subject. Three unexcused absences were allowed for the control group, while attendance requirements were not stressed for the experimental group. It was explained to the students of the experimental group that class attendance was an individual responsibility and that individual needs should determine the class attendance.

A major concern in the "A-F" grading system was to reduce the pressure of grades and to establish a higher level of understanding. The objective in the study was to motivate the student to work on an "A" level. The eleven students receiving a final grade of "A" in the control group were separated and ranked according to their achievement in each unit. In each set of eleven scores, the lowest score on the Kelly range was used for the cut-off point between the "A" and "F" grades. This point was assumed to be a minimum satisfactory level of understanding required for each unit.

A provision was made for retesting after consultation with the instructor and completion of additional study problems. Each student had the opportunity to be retested until he could show evidence of having reached a satisfactory level of understanding for each unit. At the end of the course an "A" or "F" grade was awarded each student in the class. The student receiving an "A" grade obtained an "A" for each unit in the course. If he had not satisfactorily passed any one or more units, he received an "F" grade.

At the close of the semester, twenty-three students were awarded the grade of "A". Six students received the grade of "F". Three students withdrew before completing the sixth week of the semester.

Student reactions to the "A-F" system were very favorable, and the results of the classroom research suggested that the "A-F" system should be continued. The descriptive geometry classes of the present, 1967-68, school year elected to be evaluated by the "A-F" system. The responses of all students who have been evaluated by this system and who chose to respond to a questionnaire are summarized as follows: 80% thought the course had more value, 92% believed that more emphasis was placed on understanding, 88% desired to take another course using this evaluation system, 68% indicated that their progress was evaluated more fairly, and 96% felt the methods were more helpful in developing an understanding of the subject.

I am convinced that there is merit in an "A-F" (pass-fail) grading system which places emphasis on learning. It is our responsibility to improve instruction, and when we can focus the attention of our students on learning, we will improve instruction.

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F-15.7 AIAA

Special Interest Session

NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN ELECTRICITY/ELECTRONICS

Chm., William H. Creighton; Rec., Leo Morgan; Speakers, Dean Teel, Larry Inaba; Host, Santo Randazzo.

STUDENT EVALUATION IN ELECTRONICS

Dean Allan Teel

Who, what, when, where, how and why do we evaluate? What is the objective of evaluation in electronics? Micheel and Karnes indicate in their book that we are trying to determine and measure variations among students. If it has quantity, they indicate we can attempt to measure it and we hope to be as accurate as possible.

Evaluation is a real problem for everyone who teaches. In the area of electronics, let us look at what we want to evaluate and determine how we may go about it. Let us take a look at the overall when, where, why, what, who and how.

Electronics is a very challenging area of study and teaching. It constantly poses various problems; evaluation of students is constantly in the forefront.

In recent years I've found problem-solving a very effective means of teaching in electronics. It has taken me some time to implement problem-solving and appreciate it as a teaching tool. From 1965 to 1967, I conducted an experimental study at Indiana State University dealing with scientific problem-solving versus traditional methods with groups of students involved in a beginning college course in electronics. Along with lack of experience in problem-solving as a teaching method, I also experienced the difficulties of evaluation of students in the experimental groups involved in problem-solving.

Since then I have continually tried new techniques of applying problem-solving to my class organization and continued to seek more realistic means of evaluation of students involved in my classes of electronics.

A person needs to understand the principles of problem-solving in order to use this technique effectively. What is problem-solving? The problem-solving process ideally comprises these procedures: Fact-finding, idea-finding and solution-finding.

Fact-finding calls for problem definition and preparation. Problem definition calls for picking out and pointing up the problem. Preparation calls for gathering and analyzing the pertinent data.

Idea-finding calls for idea production and idea development. Idea production calls for thinking up tentative ideas as possible leads. Idea-development calls for selecting the most likely of the resultant ideas, adding others, and reprocessing all of these by such means as modification, adaptation and combination.

Solution-finding calls for evaluation and adoption. Evaluation calls for verifying the tentative solutions by tests and otherwise. Adoption calls for deciding on, implementing the final solution.

In the classroom setting each calls for effort and imagination, but becomes a definite step in student self-evaluation of knowledge and achievement.

We for the most part as teachers will originate the problem, if understanding of electronics is our goal. At various times though, problems can be thrust upon us by force of circumstance. For clarification, let me indicate what might occur in your class if problem-centered.

Specify the problem to the class. "The problem shall be to study the common emitter amplifier." This is actually too general, so point out the problem more definitely.

"We are going to study ways of biasing and stabilizing the common emitter amplifier."

Now you have thrust the problem out into the open to the class. You have started to pull the problem apart into two concepts. A great many of the parts you will already have some knowledge about. If we can do this, you can start to work on things you don't know about.

Questions and discussion can be keyed on what is known – this is evaluation, a wide focus of knowledge related and then a narrower focus to define the sub-problems clearly.

Getting the students in electronics to know what they are looking for in lab work helps them to recognize it when they see it. This is self-evaluation.

In other words you are pre-conditioning students' minds to a narrow range of acceptable answers, again a step toward self-realization and evaluation in problem-solving. They can then predict what will occur when making tests and measurements when lab work is being done – evaluation again.

What I am saying is that the students need to be aware of what they already know about the problem and what they don't know about the problem.

Then they can realize that we need new facts. These new facts can come from reading, lecture and more meaningful lab work. They also help in forming a pattern of knowl-

dge about the concept you wish to cover, in this case, biasing and stabilization of the ommon emitter amplifier.

I believe that a certain emotional motivation state is also essential for the students n this evaluation technique I am exploring. Motivation can be catalogued in two ways: nternal and external.

The external type includes all kinds of effort-spurring incentives such as rewards f grades, prestige, publicity and other forms of recognition. Just plain encouragement s an applicable incentive. This kind of motivation can do much for the climate of the lectronics class. It can help cultivate students to self-evaluation.

This reinforcement can do much to help students work harder and helps to remove ne blocks or stigmas associated sometimes with the study of electronics.

Curiosity and variety can be two facets of the internal motivation, which can deternine the spurring power of the external incentives. Once these inner drives start to ome into play, the job of teaching of evaluation now becomes less monumental because elf-evaluation by students takes a major role. Your evaluation can then be truly one of ssistance to students in order to provide educational benefits.

Of course, you still keep records. You should accumulate data on each student beause administration still requires A, B and C. This data should be any kind of practical nd logical data that you can record.

Your personal thoughts about students can be considered valid data. Quiz scores, ab work, lab reports, personality traits and so forth should be recorded. It is much asier, however, when students, through their motivation to achieve in the problemolving challenge, can evaluate and understand themselves and accept your evaluation much more easily.

r. Teel is Associate Professor at Eastern Illinois University, Charleston, Illinois.

TRENDS IN EVALUATING STUDENT PROGRESS

Larry Inaba

Evaluation of student progress should not be a system of "passing" or "failing" a ourse, because a student's failure to learn is an indictment on our program. Somewhere, ve have failed to reach that youngster as an individual. However, there are exceptions o the case.

Evaluation of student progress covers a wide area. Evaluation for what aims? For he future? For the course? What tools are being used to measure progress?

It is my contention that we cannot evaluate student progress without evaluating our program first. Only after program evaluation can we really evaluate student progress. How can we be sure that what we offer is in the best interest of the students? Are we failng the students because we are comfortable with what we teach and how we teach?

The term "new trends" is another hard term to pin down, for what is new to me may be old to you, and vice versa. Therefore, I will not even attempt to talk of new trends in he evaluation process. However, I would like to talk about what we are trying to accomplish in Hawaii, and the direction we are taking as far as evaluation of student progress is concerned.

At present, Hawaii is in a process of change in industrial arts education. Spearheaded by legislative action, new directions and challenges are constantly being hurled at us, and we must comply or perish.

Articulation between schools and programs is being conducted, curriculum planning and design are being emphasized, and the evaluation process of students and courses is he key ingredient being brought to focus. Hence, the electronics teachers in the State of Hawaii, in answer to the challenges, are meeting to articulate our programs within he state, and to try to standardize our courses from school to school. Our discussions and planning have revolved around the evaluation process.

We realize that at the present, there are many ways in which electronics is taught n schools within the state and throughout the nation. Tools for teaching electronics

range from the various teaching systems to the simplest forms of obsolete methods of presenting electronics through out-dated projects. What should be taught at the different grade levels? How can we tell how much progress is being made from our teaching? Other disciplines have standardized measurements to give them an indication of what is needed or what progress is being made. Course offerings in areas such as math are well articulated throughout the nation. For example, a student taking algebra in New York may take second-year algebra in Hawaii because a course in first-year algebra is pretty much the same in any state. Electronics is not the same because of the project method. Some teachers stress projects while others stress more theory. Through my experience, I have learned that many transfer students whom I receive from other schools come to me with very little background in theory. Since my program is basically theory, the students suffer through no fault of their own. I submit that this should not be the case.

Our articulation committee has thought of this problem; hence, we are re-examining our philosophy and studying new ideas and methods. One method which I would like to discuss is the standardized packaged system. This system would take into account individualized instruction, and it is my belief that individualized instruction is a necessity in evaluating student progress. Our programs are ideally suited for individual instruction when needed. We must take into consideration each student as an individual with his own problems and try to help him from that point.

Let me take some time to explain the standardized packaged system that we are investigating. But before I go into the system, let me backtrack a moment to explain how we propose to have a standardized evaluation form for each unit of instruction: (1) Representatives from industry, labor, colleges, junior colleges and secondary schools will form a standards committee. (2) The committee will make recommendations, suggestions and formulate some guidelines as to what should be covered in a specific unit by preparing a standardized examination suitable to all, to be used in a packaged unit of study.

In the packaged system, the students would first take a pre-examination of the unit to be covered, in the first phase. Some students may do well in the examination because of previous experiences, while the majority will not do well at all. Therefore, in phase two, the majority of the students will obtain background knowledge and skills through learning activities such as: lectures, books, laboratory experiences, programmed material, films, magazines, etc., or whichever method an instructor chooses to teach the unit. (Suggestions of content to be covered will be recommended by the standards committee.) The students who do well on the pre-examination will do individual research on the unit. These students may choose whatever method they want, to help them solve the assigned problems. In phase three, all the students will take the standardized post-evaluation. Students who pass the examination will go on to the next packaged system. Those who fail will repeat the cycle through programmed material that will help them to pass the post-evaluation exam. Records of the units covered may be kept by the student for advanced placement, in post-high-school education. The individual instruction provided may also help students who transfer from one school to another, through individual research. Here, we can see that individualized instruction is the key to the whole process.

I have tried it on a limited scale, and thus far, the results have been quite gratifying.

Before continuing, I would like to reflect a moment about the electronic teaching systems. The electronic teaching systems are wonderful teaching devices, but mainly geared for the able students. What about the slow learners? Should we ignore them? They need lessons that are repetitious because their retention span is quite limited. Teaching systems are convenient tools of teaching, but have very little meaning for the slow learner unless programmed properly by the instructor, because they can hardly read or write, and, therefore, go through the experiments mechanically with little retention. Does this mean that they should be excluded from the field of electronics? This was my first impression until I found out differently. My first program in electronics was geared for the college-bound students as well as for the slow learner. However, in the college-bound class, since 95% of the students went on to college, basic theory of electronics was stressed heavily, while in the other class, where some students in their senior year could hardly add, subtract or divide, the course was watered-down somewhat, because I felt that they could not learn much. Through individual instruction, my concept changed tremendously. It is gratifying to see the progress being made by these slow learners through concentrated effort in a specific unit.

Let me cite an example of a case study and the progress made by the student. This boy has an IQ of about 80 and can hardly read or write. If he is given a written examination in electronics, he would surely fail, but if he is given a practical problem-type

examination, he would pass it with flying colors. He may not be able to read or write well but he knows how and why electronic components work, and the effects they will have in a circuit (such as resistors, transistors, capacitors, diodes, relays, etc.). He is also very capable in the use of any electronic testing instrument. This student can also design his own circuit with a full understanding of how and why it works. This boy will never be able to go to college to become an electrical engineer, but there is a place for him in electronics, at the service level. Look at the talent that would be wasted if we excluded him from our program, or if we failed to give him the basics he needed instead of a watered-down course. This boy would never have had the chance if he was ignored because of his poor background. Several more like him have succeeded previously.

Thus, even the teaching system needs to be programmed properly by the instructor to fit the needs of each student, if it is to be effective.

Standardized evaluation forms could also be used as tools in which we can evaluate not only student progress, but also our programs. Too many programs in electronics differ so greatly that an instructor never knows if his program is comparable to other electronic programs in the state. An instructor may feel that his students are making great progress in his course, but if his course is a watered-down version or inferior compared to other similar programs, then the progress made by the students in his class is not that great. Here, a standardized evaluation form for a course in electronics would give the instructor a good idea of the type of program he offers.

In many cases we teach many isolated facts which give students a very superficial coverage of the material, and would not be enough to help the student in passing a comprehensive examination in electronics. Therefore, another problem arises. What should we teach? Should we teach broad categories where the students gain very little in depth, or should we teach in more detail to give students a good base from which to work, in their post-high-school education? This is the dilemma with which we are faced in Hawaii. For example: In the high schools, we are directed to present a broad coverage in electronics to fit the pattern of general education. However, because of this fact, the post-high-school educators say that we don't teach enough in detail. Therefore, the students have to re-learn what was covered in high school. To solve this problem, the electronic teachers are meeting to articulate our programs to help the students. We are planning a program of early admissions to the junior college system, and an advanced placement program through examinations and recommendations by the electronic instructors.

Thus, through the packaged system and individualized instruction, we hope that we can evaluate student progress for the student's benefit. This is the general direction in which we are headed. It is a new evaluation process in which we will be experimenting and developing. If some of you have tried or are acquainted with a similar process, we would welcome your suggestions and recommendations.

In conclusion, I would like to make a few suggestions to help each other in the field of electronics. Some day, I hope, we can visualize a National Association of Electronics Instructors, whose purpose would be to:

(1) Be a center of information for the collection and dissemination of material and information, such as research papers, pilot programs in electronics, etc.
(2) Be a center of help to any new teacher who needs help.
(3) Center for the pooling of resources.
(4) Fellowship among electronics instructors.

Each state should have or form their own association with a center of information. Membership should include any educator in electronics.

Through a national association of electronics teachers, we can really begin to evaluate our programs properly and equate them nationally.

Another suggestion I would like to visualize is to see the packaged system that I have described be used in other areas with the task of teaching electronics, hence, eliminating overlapping of instruction in specific units of study. Some students often take electronics and physics concurrently and, therefore, are forced to repeat the same unit in both classes. This is a waste of students' time and could create disinterest. A uniform program that is recognized by both subject area teachers and through individual instruction would help both students and program.

Finally, since electronics is a vital program that should be known by the masses, I hope electronics will be made a vital part of education to give a student enough knowledge to cope with our electronics-minded society.

Mr. Inaba is Electronics Instructor at Roosevelt High School, Honolulu, Hawaii.

STUDENT INDUSTRIAL COMPETITIONS IN POWER TECHNOLOGY

Louis G. Ecke

The discussion which follows will endeavor to inform you concerning: (1) the his torical development of student industrial competition; (2) the organizational structure (3) program objectives; (4) basic evaluative criteria; and (5) an overview of the compe titions in operation. The major objectives of this presentation are twofold: First, th discussion which follows is designed to provide you with an insight into the organizatio and operation of student industrial competitions in Michigan. Second, it is the presentor' desire to stimulate and promote the expansion of this concept into other states.

An Historical Perspective

The impetus for the conception and development of the Student Industrial Competition resulted from a discussion and perhaps dissatisfaction with the traditional project award programs which are presently being promoted through various state associations. Som of the obvious shortcomings of such programs are as follows:

(1) Project awards programs tend to discriminate against instructional program which are not project-oriented by the very nature of the student activity
(2) The project concept frequently becomes the end in and of itself rather than means to an end or a vehicle around which learning activity may be organized
(3) The major focal point of some public school programs tends to be oriented towar the development of a winning project to the exclusion of activity which would de velop both depth and breadth of student understandings.

These shortcomings provide the stimulus for the development of a new program in th State of Michigan titled the "Student Industrial Competitions". The title connotes tha the emphasis is placed on providing public school students with an opportunity to compet in the solution of complex technical problems. The term industry was used for tw reasons. First, it was necessary to solicit financial support and cooperation from variou industries in the developmental stages. Second, the problems designed for use in the com petitions are intended to represent realistically those encountered in either the produc tion or servicing of consumer products.

A pilot program was conducted on the campus of Eastern Michigan University in th spring of 1966 under the leadership of Arthur Francis. This program involved some 20(public school students competing in four major divisions which included power technology automotive servicing, electricity-electronics and drafting. The latter category include subdivisions of architectural drawing, mechanical drawing, pictorial illustration an product design.

The competitions were expanded during the 1966-67 school year to include regiona contests held at Central, Eastern and Northern Michigan Universities. State finals were held in conjunction with the MIES Annual Convention, with appropriate trophies being pre sented to the first place winners.

During the 1967-68 school year, Western Michigan University accepted an invitatio to participate which expanded the number of regional contests to four, covering a ma jority of the state. Approximately 600 students participated in the regional contests. Students represented in the regional contest were selected on the basis of either a loca contest or outstanding achievement. Thus, the program participants represent only a small proportion of the total student population directly affected by this program.

The Power Technology Division of the Student Industrial Competitions is co-spon sored by the Michigan Industrial Education Society and the Lauson-Power Products

ngine Division of Tecumseh Products Company in cooperation with selected state uni- ersities. This is an endeavor to stimulate the further growth and development of mean- igful instructional programs deriving content from a study of various energy sources tilized as prime movers. The contest involves an inter-school competition utilizing a iree-horsepower gasoline engine commonly found on lawn equipment. Regional compe- tions are held at each of four cooperating institutions which are centrally located. The rst place winners from regional contests are invited to participate in the state finals. lans are presently being initiated to promote similar activities in other states which ltimately would culminate in a national contest.

Engines are placed in a non-operational condition through the installation of a stand- rd set of malfunctions. The malfunctions are generally restricted to the mechanical, iel and magneto systems. The students working in a team of two systematically locate nd remove the malfunctions. Typical malfunctions may include a grounded set of contact oints, shorted coil, open condenser, blown head gasket, etc.

rogram Objectives

The major purposes or goals of the competitions may be simply stated as follows:

(1) To foster a closer working relationship between the public school programs in power technology and appropriate industries.
(2) To provide an opportunity for due recognition and publicity for outstanding stu- dents enrolled in power technology programs.
(3) To focus public attention on the nature of the instructional programs provided for the youth of our nation.
(4) To provide an opportunity for job entry for the student who desires to enter the "world of work" upon graduation from high school.

There is a deep sense of excitement and personal satisfaction as public school eachers observe their students utilizing the technical knowledge and skills acquired in ie classroom to solve complex problems. The personal pride and satisfaction derived by ie participants certainly justify their involvement in this program. The contest has reated an exciting and dramatic new kind of competitive spirit among students. It has ontributed prestige and dignity to the image of those mechanically-minded youth who hoose to participate.

asic Evaluative Criteria

In the initial developmental stages of the competitions program, the only criteria for etermining the contest winners was the elapsed time. However, the evaluative criteria ave since been revised to include three major factors which are taken into consideration n the final evaluation and placement of the teams participating in the contest. These actors include: (1) a written examination; (2) time required to locate and correct the ialfunctions; and (3) the quality of workmanship. The percentages allocated to each of iese factors are as follows:

	Percentage
Written Examination	20
Quality of Workmanship.	20
Elapsed Time	60
Total	100

The written examination which consists of thirty multiple-choice questions is ad- ninistered prior to the contest. The items included in this test are designed to measure he student's understanding of major operational and scientific principles involved in arious heat engines. Test questions have been pilot-tested and subjected to an item nalysis. Each test item is worth one point with the combined score for the participants n each team being divided by two.

The most subjective part of the evaluation process involves judgment concerning the uality of the students' workmanship. This evaluation is based on the team and final udges' direct observation of the students' performance during the contest. Factors con- idered in this category include:

- Proper use of tools
- Observed safe work habits
- Team effort and procedures
- Operational condition of engine
- Appearance of engine

- Requested only malfunctioned parts

Each of the above-listed factors is evaluated on the basis of a five-point scale ᵥ ııc ranges from excellent to poor.

The score derived from the elapsed time is determined by the number of minutes : takes the contestants to locate and correct the malfunctions. The team which correct all of the malfunctions in the shortest period of time is awarded a score of forty points One point is subtracted from the perfect score of 40 points for each additional two minute that is required for the remaining teams to repair their respective engines. For example let us assume that the first team submitted their engine for final judging after 30 minute had elapsed. The next team required an additional ten minutes. The latter team woul receive a score of thirty-five points.

The scores for each evaluative criterion are added to determine the contestants final score. Appropriate trophies are awarded to the first, second and third place teams Individual certificates are presented to all participants, which relates to our objective c student recognition.

Contributions of Industry

The Lauson-Power Products Engine Division of Tecumseh Products Company ha made the following kinds of commitments to the Power Technology Division of the Studer Industrial Competitions. They will provide:

(1) Adequate copies of an Operations File, which includes information regardin competition rules and regulations, official tool and equipment list, engine and part procurement, basic judging criteria, mechanics manual, etc.

(2) A sufficient quantity of 3-Horsepower Horizontal Shaft Competition Approve Engines, number 754131, at a cost of $25.00 net. Each school orders the engin directly from Tecumseh Products Company.

(3) A sufficient quantity of replacement parts at no charge to be used in the regiona competitions. These parts are requested by the state director who distributes ther to the various institutional directors.

(4) Five free engines and five sets of replacement parts for use in the State Finals The engines become the property of the host institution upon completion of the contes

(5) A factory representative to act as one of the three final judges at the state finals

(6) A distinctive show-case type first place awards for both the regional competi tions and the state finals.

(7) A certificate of participation for all students who compete.

(8) Continued support of the Student Industrial Competitions, which includes workin with the other participating manufacturers to develop a unified spirit.

In addition to the above-listed contributions, Tecumseh Products Company has pro duced a 16 mm film entitled "Student Industrial Competitions in Power Technology" which may be ordered for viewing directly from the author of this manuscript. This film depicts the activity involved in the state finals.

Organizational Structure

The structure through which the operation of the Student Industrial Competitions pro gram is carried out is perhaps best portrayed by an organization chart. (Opposite page

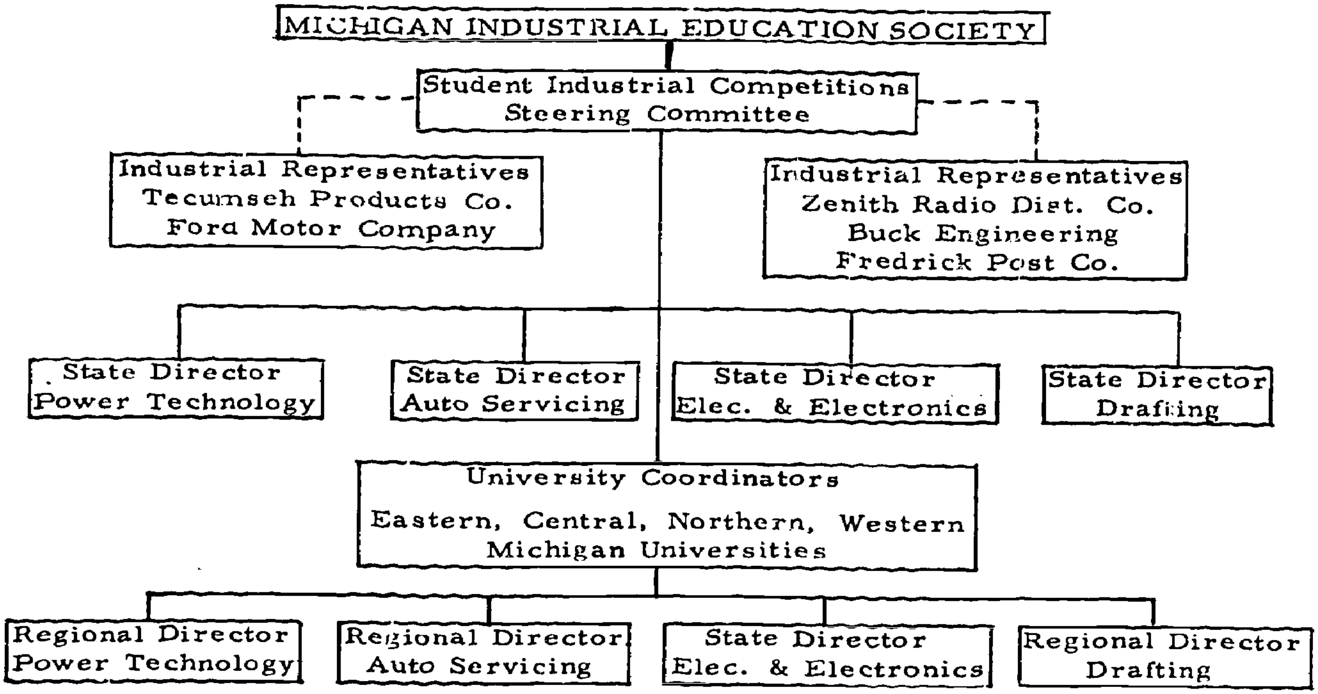
The chairman of the Student Industrial Competitions Steering Committee report regularly to the Michigan Industrial Education Society Board of Directors. The steerin committee is composed of the state directors and the university coordinators. The indus trial representatives may participate in the deliberations of the steering committee However, it has been our experience that they prefer that educators deal with the prob lems of the organization and operation of the competitions.

The state director's responsibilities would involve: (1) the coordination of all re quests and communication with the industrial representative; (2) the establishment c operational guidelines; (3) the ordering and disbursement of replacement parts; and (4 the organization and operation of the state finals.

The university coordinator is responsible for the orderly operation of the regiona competitions. Major responsibilities are delegated to the regional directors in each c the technical areas.

Other activities omitted in the organizational chart are the public relations functic and the development of pilot programs.

In conclusion, the development of the Student Industrial Competitions has provide public school students with an excellent opportunity to display their technical knowledg



and skills. The public relations aspect of this program as well as the personal pride and satisfaction derived by student and instructor tend to justify the continued expansion of this program.

As an evaluative technique, the competitions tend to provide a basis for program innovation and change. Observation of the student's performance does provide insight into his technical skills and knowledge, as well as his work habits.

As to the future, the writer would hope the participation and interest in this program will allow for the expansion of the Power Technology Division to include areas of competition in rocketry, jet engines, etc., with major emphasis being placed on the operational characteristics with the design and construction aspects remaining within the realm of the project awards.

Dr. Ecker is Assistant Professor, Department of Industrial Education, Eastern Michigan University, Ypsilanti.

F-15.9 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN WOODWORKING
Chm., R. O. Johnston; Rec., Bill Cady; Speakers, David A. Rigsby, Willis Wagner; Host, William J. LaCroix.

STUDENT EVALUATION IN WOODWORKING

David A. Rigsby

Gentlemen, I am to talk to you on "New Concepts in the Evaluation of Student Progress in Woodworking." I think I would like to divide this time allotted to me into two parts. First, I would like to tell you about my experience with Education Testing Service and how a test was built.

I was asked to serve with the Committee for Industrial Arts Wood Tests. This committee met in Princeton, New Jersey. The first night was for social activity. We then had

two full days and one night of hard work. When I arrived, I found there were two teache educators, one state supervisor, and five wood teachers. Three of these people I knew quite well. The other four I soon got to know and found that they were people with a fine background. We worked with six people from ETS who were experts on preparing tests The eight of us were supposed to supply the wood part.

The job laid out by ETS was to build a test for junior high school woodwork. It was decided to test the results gained in an eighteen-week period of 250 minutes per week and to give the tests to eighth-grade students.

The committee was informed that the test to be developed would contain fifty question and would require 35 minutes of testing time. The test would cover knowledge, understanding and skills; and the committee decided to cover hand and power tools, knowledge about various kinds of wood, and an understanding of planning and designing projects, cutting to size and shaping, jointing, fastening and finishing. We also felt that safety and some information related to the wood industry should be covered.

We were then given a short course on test writing by ETS personnel. This was by far the best instruction I have ever experienced in test preparation.

The topics were broken down into detail as to just what we thought ought to be covered It was then determined just how many questions there would be in each sub-topic and what types of questions they should be.

All eight members of the committee then went home and wrote a complete test over the next several weeks. These were sent to ETS, edited and rewritten; the whole four hundred questions were sent to the committee members to go over and be returned to ETS From these, ETS will prepare the final test.

I have a completely different feeling toward standardized tests and what they will do or what can be done with them than I did before; and that is the reason I wanted to tell you about this.

However, I think we all should remember that in the industrial arts lab, we have an opportunity to work with all the students on whatever level they happen to be. We should not try to bring them all to the same finishing point but help each child develop as far as possible.

I think all of us would agree that there has been a drifting apart in education of science and humanism. This was noted over thirty years ago by George Sarton in his volume, "The History of Science and the New Humanism." Sarton said: "The main issue does not simply concern humanism but the whole of education from the cradle to the grave. And the real question is: Will education include science, or will it exclude it? The intellectual elite is at present divided into two hostile groups, which we might call for short the literary and scientific, who do not speak the same language nor think in the same way. If nothing is done, the gap separating them must necessarily increase, together with the steady and irresistible progress of science. Shall we deliberately widen the gap as the old humanists would have it, or shall we take special pains to reduce it as much as we can?"

I believe this gap has been widened over the years and that it is time for some of us in education to start thinking of the child whom we say we are preparing for the future.

I would like to share with you a story that appeared in Loren Eiseley's "The Firmament of Time." It concerns a man who was one of the chief architects of the atomic bombs. The man, one of our foremost atomic physicists, was taking a walk in the woods one day with a friend when he came upon a small turtle. He picked it up and started home intending to surprise the children with it. After a few steps, he paused and surveyed the animal doubtfully.

"What's the matter?" his friend asked.

Without responding, the scientist retraced his steps as precisely as possible and put the turtle down in the exact spot where he'd found it.

Then he turned to his friend. "It just struck me," he said, "that perhaps, for one man, I've tampered enough with the universe."

The man, Dr. Eiseley pointed out, did not deny science by his action. He simply recognized that science is not enough. Humanity also is necessary.

The time has come for industrial arts teachers to put much emphasis on the humanity part of education as well as the scientific facts. The industrial arts lab is an ideal place to bring the two together and work with the whole child.

We must remember to evaluate a child so as to encourage him to future accomplishments.

It is our obligation in industrial arts to take a child where he is and take him as far as possible. It is not our job to sort out the good from the bad or the different levels o

achievement.

Let's remember that we are the keepers of the public's children. And being entrusted with this position, we should work to our utmost in helping each child to become better adapted to everyday living in our modern society.

Mr. Rigsby is Associate Professor at Appalachian State University, Boone, North Carolina.

EVALUATION OF STUDENT PROGRESS IN WOODWORKING

Willis H. Wagner

Not so many years ago, informational content in woodworking courses was largely covered in regular class sessions – in fact, many students elected this area of the industrial arts curriculum because of the minimal amount of outside study normally required. Great emphasis was placed on the construction of a "project" and, as a result, the "grading of the project" constituted the major aspect of evaluating student progress.

Today, research and development in the wood and wood products industries provide a vast amount of scientific and technical information concerning new methods, materials and procedures. To acquire even a limited understanding of the basic concepts and generalizations in the field, students in modern woodworking courses will need to devote many hours each week to "out of class" study assignments.

The written examination, when properly prepared and administered, can provide an important motivating force to "drive" students into a good, hard, concentrated study of informational material. Another prime purpose of the examination, of course, is to reveal concrete evidence concerning the progress students are making in the acquisition of information about woodworking tools, machines, equipment, materials and processes. Items used in the examination should be representative of the course content – the course content having been selected and established to fulfill the course objectives.

Modern woodworking test items should be up-to-date and, along with course content, should reflect recent developments in wood processing and wood-related materials. For example, a completion question in the area of adhesives might read: Two chief disadvantages of polyvinyl resin emulsion glue are: it softens when exposed to elevated temperatures, and it is____________.

Many instructors make an effort to design items that require more than a simple "feedback" of memorized information. Listed below are several examples of test items where the student, in order to arrive at a correct response, will need to know certain facts and also how they are applied:

--What is the cutting speed (SFM) of a 20-in. band saw if the wheels turn at a speed of 800 rpm? Use the space below for your calculations.

--If a wood sample that weighed 56 grams was completely over-dried, and then found to weigh 50 grams, the initial MC would have been_______.

--List in the proper sequence the operations you would perform in bringing to finished size: 6 pieces – 3/4 x 3 1/2 x 34 inches which must be cut from a single piece of rough stock 1 x 8 x 108 inches. The rough stock has some bow and one end shows some cup – otherwise there are no defects. Identify the machines or tools used in each operation.

In woodworking courses, student performance continues to be highly important and should therefore be a major factor in the total program of evaluation. A high percentage of this performance involves the development of skills and is based on an understanding of methods and procedures. For the most part, progress will be reflected in the quality and quantity of work produced by the student. However, simply grading the work (product or experimental project) when completed will usually not provide sufficient evidence of the student's progress along this line. Since the developmental process in the student is continuous (we hope), then the evaluation process should also be continuous. As the instructor observes the student's performance from day to day, he certainly will be able to form significant judgments concerning the progress the student has attained. Some type of check sheet should be developed for recording and summarizing these judgments. If an

evaluation procedure, as described, is placed in operation, the student should be acquainted with the system and have some indication of his rated progress at various intervals.

In addition to the student's performance directly related to constructional activities, there exists a need for some method of evaluating other aspects of his shop work. This would include such elements as: cooperation with other students; following established policies in organization and management; care in handling, storing and using materials and supplies; and participation in the care and maintenance of tools and equipment. Performance in these areas is of tremendous importance because it is so closely coupled with attitudes and personality traits.

Some systematic method of evaluation in this area should be considered. An appropriate instrument might consist of a rating scale especially structured to match a particular situation. One recommended form lists desirable descriptions of performance with check points under such headings as: outstanding, satisfactory, needs improvement and unsatisfactory. Another design lists desirable practices on the one side, undesirable practices on the other, and rating check points between as illustrated below:

Cooperates well with others, respects their rights and is always courteous, tolerant and helpful.	5	4	3	2	1	Largely concerned with self. Shows little respect for anyone, especially those who can't do him a favor.
Follows recommended safety practices. Uses tools and machines correctly. Always wears safety glasses and uses push sticks and other safety devices.	5	4	3	2	1	Breaks safety rules and feels guards and safety devices are "for the birds". Uses them only when instructor is watching. Seeks approval and recognition from peers by taking chances.
Takes good care of tools and equipment. Follows correct practice in their use. Returns items promptly and reports loss or breakage.	5	4	3	2	1	Has little or no respect for equipment. Handles and uses it carelessly. Seldom returns equipment to its proper place. Never reports breakage.

Rating scales might also be designed to amplify the check points by drawing lines (forming a profile) between them. Some instructors prefer to vary the emphasis placed on the various descriptions through the use of a point system.

Although rating checks are usually made by the instructor, there are situations where ratings by other students might be appropriate. Also it may be helpful for the student to rate himself at various intervals. Regardless of the rating system used, good educational practice would demand that the student be fully informed of the system and his indicated progress.

Mr. Wagner is Professor of Industrial Arts and Technology at the University of Northern Iowa, Cedar Falls

F-15.10 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF STUDENT PROGRESS IN PLASTICS
Chm., William B. Landon; Rec., Gregory Scherman; Speakers, Armand G. Hofer, Maurice Keroack, Lloyd Schrum; Host, Raymond DeKeyser.

EVALUATION OF STUDENT PROGRESS IN PLASTICS

Armand G. Hofer

Whether we are interested in evaluation to assign grades or evaluation to determine the effectiveness of teaching, it should be aimed at determining the extent to which each student has reached the objectives of the course or unit. This sounds simple enough, but too often we don't do a very good job of evaluation because: (1) the objectives are not well defined, (2) we don't keep the objectives of the course in mind when making out the evaluation instruments or (3) we don't weigh the evaluation of different areas in relation to their importance. These problems are, of course, not unique to the plastics area.

Since the evaluation in a course is so closely related to the objectives, it appears that the objectives and evaluation devices or procedures should be worked out before the exact course content and teaching methods are selected. The aim of the course or unit is to bring about a change in the student, therefore, the objectives should be stated in terms of student behavior that can be observed or measured in some reasonably accurate way. An objective might be stated "to learn about the plastics molding processes", or to "understand" the plastics molding processes. When does a student "understand" a process? We need to be more specific by listing the ways we can detect just what it is that we wish to define as "understanding" a process. To some this might mean listing the steps of procedure; to others it might mean being able to describe the applications of the process or the advantages and disadvantages of the process. After the objectives have been stated in specific terms, they shouldn't be kept a secret from the students. The students will learn better if they have a clear idea of what is expected of them.

In making out the objectives and evaluation procedures, we should keep in mind the overall objectives of the institution. If we profess, for example, to teach "creativity", then perhaps each class should contribute toward it. There is always a question as to what weight each part of a student's performance should have (assuming that we must assign a single "grade"). This will be a matter of individual choice, but it should at least be kept in mind in setting up the evaluation system.

The ultimate in instruction and evaluation would be individualized instruction, with a student working on a given area until he reaches at least a minimum level of achievement before advancing. Evaluation in such a system would demand that the student work toward a certain standard rather than being graded on a curve against the rest of the members of his class. Individualized instruction and criterion-testing may sound like an unrealistic system for mass education, but it is being implemented in other areas and is perhaps the direction in which we should be going.

Dr. Hofer is Associate Professor at Stout State University, Menomonie, Wisconsin.

AN EVALUATION SYSTEM AT S.U.N.Y., BUFFALO

Maurice Keroack

The two major purposes served by an effective evaluation system are: (1) to help the teacher determine the degree to which his educational objectives have been reached, and (2) to help the teacher know his pupils as individuals.(1) The first purpose is basic to established educational norms, which indicate that evaluation is always in terms of educational goals. The second purpose is related to the first insofar that if the teacher becomes acutely familiar with his pupils, he will be in a better position to plan meaningful experiences for them. He will also be in a better position to determine the degree to which his educational objectives have been met.

In order to implement the two major purposes of evaluation in a plastics program, several goals have to be established. If the objective of the course is to produce plastic

pump lamps, then a criterion for evaluating the pump lamps must be established. Thi could be accomplished by a long check-list of points to be considered when examinin the lamp; or the lamps could be individually thrown and then the distance measured and sliding scale used to determine grade. The only section of this procedure that has valo is the part where you throw the lamp away.

However, if the objectives of the course are to expose the student to significantl important processes common to the plastics industry, then an evaluation technique ha to be developed that is based on sound educational goals.

With a comprehensive plastics program, the diversity of processes encountered lend itself well to the following weighted procedure for measuring the two major purposes o evaluation. (See evaluation sheet.) If a group of pupils has difficulty completing a give area, it readily shows up on the critique sheet. The instructors can then take remedia steps to clear up any misunderstanding or other problems in that area. This allows fo flexibility in the program and allows the teacher to work frequently with the students. Wit constant contact between student and teacher, the second major purpose is served.

The weighted system is devised in such a manner as to provide for the maximun fairness to the student. It allows for individual creativity on the part of the student, ye establishes a clear set of requirements to be relatively sure that major education goal have been met. A balance of practical manipulative skills and written work is achieve by weighing the written work.

There are more suggested areas than would normally be expected from an averag student in one semester. In this way room for growth for the exceptional student i allowed. The average student will probably cover 80% of the listed areas. This is a sufficient base upon which to grade the individual. There is also room for a variance i quality of the work performed. The ten points maximum allowed for the area are established as the criteria for a satisfactory job. Therefore, an emphasis is not placed on th quantity of machine operation as long as minimum standards are met. This type of emphasis is vital in a plastics program, because much of the problem-solving does not com from the manipulative skill of the machine operator. Most of the problem-solving i achieved by balancing the variables inherent in the material and process.

This system also allows for extra credit for the student who wishes to excel.

The student's raw score at the end of the course is plotted on a curve based on al previous classes, and a letter grade is established in relation to his performance to pas students' performances.

When new areas or teaching techniques are employed in any given semester, th effect of the new material can quickly be compared with previous groups to see if the nev techniques were useful in achieving educational goals.

FOOTNOTE

1. Ahmann, Stanley J., Glock, Marvin D. Evaluating Pupil Growth Principles of Test and Measurements, 1967, p. 4.

Mr. Keroack is Assistant Professor at State University College, Buffalo, New York.

EVALUATION SHEET

Student's Name ______________________ Final Grade [ ]

	Max.	Yours
Vacuum forming	10	
Vacuum forming mold	10	
Low Pressure Laminating	10	
Polyurethane foam application	10	
Polyurethane foam mold	10	
Polystyrene Expandable bead application	10	
Polystyrene Expandable bead mold	10	
Engraving	10	
Hot dipping - vinyl dispersions	10	
Hot dipping - fluidizing bed	10	
Cold dipping	10	
Heat sealing, Radio frequency	10	
Heat sealing, Ultrasonic	10	
Heat sealing, thermo-sealing	10	
Welding	10	
Rotational molding	10	
Vacuum metalizing	10	
Injection molding 3/4-oz. machine	10	
Injection molding 3-oz. machine	10	
Injection molding mold	10	
Hand lay-up Polyester reinforced plastics	10	
Hand lay-up Polyester mold	10	
High pressure laminating	10	
Tensile Testing	10	
Blow molding	10	
Encapsulating	10	
Tool Holder	10	
Extra Credit	10	
Extra Credit	10	
Extra Credit	10	
Quiz #1	10	
#2	10	
#3	10	
#4	10	
#5	10	
Midterm Notebook	20	
Midterm Test	30	
Final Notebook	50	
Final Test	70	
Raw score total	530	Your Raw Score

Class Range Raw Score

A =
B =
C =
D =
E =

Final Grade [ ]

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EVALUATION AND OBJECTIVES

Lloyd V. Schrum

When we started our teaching careers, we undoubtedly followed a course of study very closely. It may have been something we compiled or one that was handed to us. When the first year came to a close, we were to evaluate our students and the course as we had taught it. This could well have shocked some of us when we tried to evaluate according to the objectives of the course.

Therefore, I believe that we should take another look at our objectives. Can they be evaluated? If not, we had better rewrite or otherwise change them to give something concrete to use in evaluation. The students too should know what is expected of them, so that when the final grades for the course are given out, they know that they have had a valid appraisal of their capabilities.

The area of plastics is becoming broader every year and is being added to the curriculum in many of our industrial arts areas. It is time, then, to reassess our objectives and consider them with respect to the area in which we are teaching. The objectives for our courses should be written so that students of all levels can attain goals within their capabilities.

In the area of plastics, the student should gain knowledge of terminology, specific facts, trends, basic principles of design, classification and categories. This objective may be evaluated by tests, written reports, oral reports and on the plans he presents to make a project.

The student should also comprehend by means of explaining why he has chosen a certain type of plastic for a given project. He must interpret the knowledge he has gained from reading, films or other educational media and come forth with uses as well as limitations for his project. This can be evaluated by checking his complete plans and discussing it with him.

The student is then ready to identify and solve the problems that he will encounter in making his project. He must decide on the design, since this may limit functions of the project, or be limited by types of plastic that may be used. He will need to determine the operations necessary to complete his project and the best-suited materials. He will have an equipment list and a detailed drawing to follow. His design or plan can be evaluated as to organization or lack of it, relationships of parts in the design as well as choice of materials. This includes colors, strength, resistance to weather, heat, cold, wear, constant flexing or many other characteristics found in plastics.

It is also important that we consider the student as a person, and try to meet each student at his own level. Benjamin S. Bloom has completed a study on course objectives and student behavior traits and found that there are six major classes in the cognitive domain. His study is entitled, "Taxonomy of Educational Objectives: The Classification of Educational Goals", Handbook I, Cognitive Domain, published in 1956 by David McKay Co., Inc., of New York. The six major classes are: knowledge, comprehension, application, analysis, synthesis and evaluation. Each of these classifications has subdivisions that may be set up as grading criteria for daily, weekly or final evaluation.

When writing tests, or planning our course of study, let us try to determine which level of the six classes we are trying to reach. Each level of the classification builds on the previous level or levels. In the field of plastics, design of molds is a very important aspect of the completed project. This could well be an evaluated objective of the course rather than to have students completely plan the project they are to make. This would go through level four, or analysis, because the student would have to understand problems peculiar to mold making. This would in turn require knowledge of materials used in making molds, as well as design limitations, and types of plastics that can be molded in the manner in which he will mold them. He will need to know various molding processes so that he can determine which is best for his project. He must know relationships of materials to molds so that he can accurately predict what repeated runs with his molding will do to tolerances required on the finished project. If he were to attain level five or synthesis, he would be faced with production problems, plans of operation for mass producing, cost of materials on a volume basis, and cost of equipment as well as maintenance, and many other areas that might seem abstract to the student. Level six would deal with evaluating the product. This would include judgments of internal evidence as well as external criteria.

When we evaluate the end product, we then have a set of objectives or criteria that can be evaluated, including the capabilities of the student. We may still ask that he take a final test, or write a report on total project that he has done, which will give us a further insight into his capabilities or ability to use what he has learned. When writing tests, we must be careful that we use test items that are valid and not trick questions, or questions that may be misconstrued due to poor wording. Some of the students tend to read into test questions things that we did not intend to ask or expect. Item analysis of our test questions often gives us valuable information as to their validity and reliability. We often do not take time or have time to do an analysis; however, if we wish to improve our courses and teaching, it is important that we use every possible means to insure an accurate interpretation of test results.

In summary, then, evaluation depends on the use of objectives that are realistic and attainable to students. They should provide for a broad background of knowledge of plastics and the plastics industry through various educational media. The student must be given a problem that will allow him to comprehend, apply, interpret and analyze before he starts work. He may also be given the opportunity to evaluate his project. If the student can be evaluated on this type of criterion, we will have taken him at the level he was working and advanced him to a higher level. Some of us may have put these objectives to use and have a first-hand knowledge of how students react to this type of evaluation.

Mr. Schrum teaches industrial arts in Minneapolis, Minnesota.

F-15.11 AIAA
Special Interest Session
NEW CONCEPTS IN AEROSPACE EDUCATION
Chm., John Winterhalter; Rec., John Kerr; Speakers, Hal Mehrens, John Winterhalter, Charles Swinford; Host, Donald P. Lauda.

INDUSTRIAL ARTS AND SPACE TECHNOLOGY

Harold E. Mehrens

Industrial arts is a study of the tools, materials, processes, products, occupations and related problems of our American industrial society.

Today, approximately 4,000,000 students are enrolled in industrial arts courses throughout this nation and are taught by approximately 40,000 teachers. These students should be aware of the implications of industrial arts for the aerospace industry and the space program itself. The aerospace industry is the largest industry in our nation today. It employs over 1.3 million persons. By comparison, approximately 780,000 individuals are employed in the manufacturing of automobiles, trucks and motor vehicles. An in-depth study of the aerospace industry will provide students with an opportunity to investigate not only this important area of our American economy but also directly related industries, such as electronics, chemicals, communications and transportation.

The industrial arts teacher should emphasize to the student that a solid, fundamental course in industrial arts is as basic to work in the aerospace industry as it is in any of the other major industries. In the occupations related to the aerospace industry, it is desirable for the student to have a good background in physics and math.

The student can be motivated to higher standards of craftsmanship and pride in workmanship by relating his educational experiences to the space age. It should be emphasized that there are thousands of aerospace employees working in occupations that are exactly the same as those required by many others of the major industries.

One does not need a college education to work in the aerospace industry. One must, however, have a dedication to the vital nature of the job; a welder must understand that

the success of a launch depends as much upon his skill in producing a welding job with zero defects as it depends upon the research physicist and the engineer in arriving at a vehicle design which is without error. Skill and reliability are perhaps the two most vital aspects of the individual's training and background.

It has been a long-standing practice to assign problems to students. Usually this involved the construction of an object. Industrial arts teachers can stimulate creative thinking by giving students the opportunity to relate these problems to the aerospace industry. This will permit the student to try out new ideas and materials and gain a better understanding of our nation's largest employer.

To aid the industrial arts teacher in posing problems, NASA issues tech briefs periodically. These publications are intended to summarize specific technical innovations derived from the space program. These are free and may be obtained from John F. Kennedy Space Center Education Office. The manual "Model Spacecraft Construction" is also available to help in formulating projects.

There are some individuals in industrial arts who feel that simple hand and machine tool skills have become obsolete. These are the individuals who say that mass production and automation have eliminated the need for using simple hand tools and machines skillfully. While this may be true to some degree, the aerospace industry requires a return to the demand for individual craftsmanship and pride in workmanship. There is a great need in the aerospace industry for individuals who possess high standards, who may have developed articulate hand tool skills, and who can work with high standards of quality control. One must remember that the success of a mission and the lives of the astronauts depend on how efficiently each person performs his job.

One of the most challenging aspects of the aerospace industry is the ever-changing American industry. The workers must be able to adjust to this changing environment. Each generation of launch vehicles quickly goes through the cycle of design, development, operation and obsolescence.

The challenge of the aerospace industry is great, and the role of the industrial arts teacher is very important to interpret the industry to the students of our schools today.

Since industrial arts courses in our schools today have the responsibility of defining the role of industry in our society, let us look at industry for a few moments.

Industry can be defined as the sum total of all the activities required to produce a product. Things such as the television set, car and rockets, as well as services. We can see that industry is involved with the production of goods and services.

Industrial arts is primarily concerned with industries which produce goods. In other words, it concentrates on the manufacturing industries and is concerned with the ways in which raw materials are transformed into usable products. Automation is usually thought of as being commensurate with products, because industry can produce more and therefore can sell for less. However, in the aerospace industry, the scheme of producing relatively few models of the product with optimum quality must be considered. The concept of zero defects is mandatory and not just a desirable factor.

Tech briefs, NASA fact sheets and NASA films on satellites and space probes help to emphasize the individual craftsmanship involved in the construction of aerospace devices.

The elements of industry are the same whether you are producing bicycles or rockets: only the matter of numbers of products and more rigid specifications is required.

The aerospace industry is the industry that reflects all aspects of the American industry. Space vehicles require products made of ceramics, plastics and metals as well as power and electronic components. The products must be designed, fabricated and tested. Invariably some products have their birth as mock models made of wood. This not only saves money and time but permits the designer to experiment with various designs more readily.

It is evident that industrial arts can make a significant contribution to understanding the aerospace industry, since it also is concerned with the same areas.

Traditionally, industrial arts is divided into eight categories: design and drafting, metals, electricity-electronics, power, graphic arts, plastics, ceramics and wood. Each category can be related to the aerospace industry.

It is suggested that you provide the in-depth information in your classroom.

(1) Design and Drafting: Design tools for repair or assembly operations on vehicles during space flight. When energy is applied to components of a weightless space vehicle, such as turning a bolt with a wrench, the vehicle itself will react by turning if sufficient pressure is required for the operation. This problem could be experimented with by

trying to drill a hole in a tennis ball while it is floating in a pail of water. Also consider the problem of collecting the chips. Even the slippage of a tool being used under excessive pressure could result in a serious problem, especially if it is dropped from the user's hand. Further, where a variety of tools is required for a single repair operation, they must be secured by some method while not in immediate use. Consider magnetism and its effects, both positive and negative, as a possible way of retaining the tools.

(2) Metals: Under the beryllium shingles are thermoflex radio frequency blankets held in place by a titanium mesh attached to the metal stringers.

The adapter is a ring-stiffened skin-stringer structure consisting of circumferential aluminum rings, extruded magnesium alloy stringers and a magnesium skin.

Eighty-five percent of the cabin section, which includes equipment bay doors and hatches, is made of welded titanium assemblies.

Two hundred eighty-five inches of hand fusion welding are required to mate the thirteen titanium pieces of each hatch.

Steel is used extensively in the ground support activities. In the Apollo project, for example, there are the Vehicle Assembly Building, the mobile launcher, the mobile service structure, the supporting structure for the flame diverter, portions of the liquid fuel and the purging of gas storage tanks, the huge tracked crawler/transporter and many others.

The micrometeoroid satellites contain pressurized beryllium copper cylinders, copper wire (2 or 3 thousandths of an inch thick) grids, aluminum sheet (.0015-, .008- and .017-inch) panels to record the number encountered.

The major structural material for the Apollo service module and the Lunar Module is aluminum.

The NASA Lewis Research Center authorities suggest that the aerospace age is the "age of tailored materials" since no single material can serve all of the many technological applications required. In addition, metallurgists are designing improved fabricating characteristics into alloys.

The shingles on the surface of the Gemini re-entry module are alloyed of several metals – 53 percent nickel, 19 percent chromium, 11 percent cobalt, 9.75 percent molybdenum, 3.15 percent titanium, 1.6 percent aluminum, .09 percent carbon, .005 percent boron and less than 2.75 percent iron – to provide aerodynamic and heat protection in addition to holding insulation in place.

Work at Pratt and Whitney Aircraft emphasizes a materials spectrum which ranges from stainless steel and iron-base superalloys, to magnesium, aluminum, titanium and all varieties of advanced high temperature nickel- and cobalt-based super alloys.

The NASA contractors and NASA experimental and maintenance laboratories all make extensive use of customary machine shop equipment. A part must often be made that has never been made before. Various jigs and fixtures facilitate even limited quantity production and help maintain required tolerances for precise equipment.

(3) Electricity-Electronics: The area of electricity-electronics as applied to aerospace technology is almost limitless. It is said that electronics is the heart of the program, and all phases of electricity provide the means to accomplish the many production tasks required in the manufacturing and assembly processes.

At least 98 percent of all components used are of solid state type. There is a concerted effort being made toward miniaturization.

Chemical batteries are used for transportation vehicles and in the principles of the fuel cells for powering spacecraft equipment. Silver, zinc and nickel cadmium cells are also extensively used in spacecraft

Computers and associated controlling mechanisms or indicators are essential to the maneuverability of the spacecraft. Basic principles and application of circuits are used extensively for telemetry, instrumentation and communications.

High voltage power sources employ backup or dual circuitry to assure constant voltage with little variation. Three-phase, four-wire power instrumentation circuits are being made to assure dependability and reliability.

The ground control system must have a reliable power source. Dual service feed lines with automatic switching to alternate sources all performed by crossbar or solid state components. Extensive use of relays and microswitching is evident in all parts of booster vehicles and capsules.

Converters, inverters, transducers, sensors and many other controlling or regulating devices are employed on both electrical and mechanical components. Almost all operate from the standard 24-28v DC system supplied from solar or fuel cells.

Demonstrate the use of relays and converters in supplying power to model trains, cars, airplanes, etc. Hook up a three-phase, four-wire low voltage circuit and demonstrate automatic switching.

Almost all switching is done by solenoids, fuel control systems, vibration readouts and the majority of the other 3,000-plus measurements that are taken on Saturn flights. Large power step-up and step-down transformers are used in transmission of electrical energy. Large electromagnets are used in metal forming. Transformers are used in all circuits and welders.

Sound, radio, light and almost any other type of wave form or motion are involved in space travel. Radio and telemetry signals are used for communication and control. Vibration and shock waves must be overcome to maintain stability through thrusters. Crystals are used to stabilize transmitters.

Semiconductors, transistors and solid state components are used extensively in computer equipment, telemetry circuits and space capsule equipment. Strain gauges, sensors and other delicate instruments requiring low current and small space also use these items.

(4) Power: Small gasoline engines are used at the launch site on standby and emergency machines. The awesome sight of million-pound thrust engines contrasts dramatically with two- and four-cycle engines on water pumps, air conditioners, coolers and emergency generators.

Cryogenic fuels are used in many rockets. These extremely cold liquids are used to cool the nozzle of the thrust chamber. This nozzle is actually a honeycomb of tubes and fins much like a water-cooled radiator of an automobile.

In conventional engines the problem is to have a clean air-fuel mixture of the proper proportion. The space industry is faced with this problem plus the additional problem of providing a combustible agent outside the earth's atmosphere and of greatly increasing the combustion rate.

Because rockets must have a self-contained fuel supply in order to function in space, the fuel and oxidizing agents are stored in separate tanks and mixed under pressure. How does this differ with fuel intake and mixture of gasoline engines?

Diesel engines are in evidence throughout the space launch facilities. They are used on standby equipment and for emergency power generation.

Perhaps the most vivid use of diesel power in aerospace activity is demonstrated in the crawler/transporter which transports the Saturn V launch vehicles and their launchers (mobile) from the Vehicle Assembly Building to the launch pad.

This vehicle weighs 6,000,000 lbs., is 131 feet long and 114 feet wide. It moves on four double-track crawlers, each 10 feet high and 40 feet long. Each pad weighs about one ton.

This vehicle is powered by two, 5500-horsepower diesel engines. Two other diesels generate 2,130 horsepower for leveling, jacking, steering, lighting, ventilating and electronic controls.

Space industry application of the gas turbine engine can be found in the larger helicopters used in search and recovery operations and in the experimental aircraft, such as the Vertical Short Take Off and Landing (VSTOL).

(5) Graphic Arts: Photography has become an essential tool in the development, firing and testing of spacecraft. Markings and patterns are painted on the missile so that engineers studying the photographs of the missile during launch and flight can detect even the most minute deviation from the predicted results. Motion pictures of the launch are taken at many different speeds, ranging from 4 frames per second to 2,000 frames per second.

Cameras mounted on the space vehicle and on the launch gantry are used to record every phase of the launch operation. Some are trained on mechanical devices, some on instruments and gauges and some on the astronauts. In many instances, the picture needed requires that the camera be mounted in an area of intense heat. Cameras mounted in flame areas are shielded from the heat and force by being housed in steel boxes with quartz to protect the lens.

When cameras are mounted on those stages of the vehicle to be jettisoned, they are equipped with separation devices and flotation material. One such camera was recovered after twenty-six days in the water, and the pictures were excellent.

Camera equipment on unmanned capsules converts pictures into electrical signals to be transmitted to earth, where they are reconstructed.

Cameras located in danger areas are remotely operated during launch. There are some permanent remote camera stations at launch sites, but many stations are mobile.

The unusual demand on space photography necessitates the use of every conceivable type of lens. Research into lenses for space use should also result in improved commercial and personal equipment.

Space industry photography demands results heretofore not possible. Research into equipment and materials has resulted in many developments which are beneficial to commercial photography. One of these is a low-light, high-speed color film.

Schematic layouts of circuitry used in electronic equipment are reduced in size through the printing process. These circuits are then "screened", using metallic electrical conductors in the form of paint. This eliminates wiring and allows miniaturization of the circuit because soldered or mechanical connections are not needed.

Motion picture cameras with a wide variety of lenses and speeds have substantially helped space engineers to locate malfunctions. These speeds range from 2 to 2,000 frames per second.

(6) Plastics: The material used as a heat shield for the command module must withstand temperatures in deep space colder than 200 degrees (Fahrenheit) below zero and then survive the intense heat of re-entry, when the shock and friction caused by the craft slamming into the earth's atmosphere will send temperatures across the surface of the command module soaring as high as 5000 degrees Fahrenheit. In addition, since the weight of the command module must be kept to a minimum, this material must be of the lowest possible density.

The material selected to do this job is a phenolic epoxy resin — a plastic. In addition to this plastic itself, the resin is held in place on the surface of the command module by a honeycomb matrix of fiberglass — a combination plastic ceramic material. Thus, it can be seen how the plastics are used in space technology in a highly important area. Without the heat shield, it would not be possible to put a man on the moon in the near future.

(7) Ceramics: Ceramics has been of equal importance in arriving at the point where the Apollo Command Module could be designed. From the time that astronauts Alan Shepard and Gus Grissom performed their epoch-making "first" flights in 1961, ceramics has had its impact on space vehicle design. Even before these important accomplishments, without the ceramic potential of withstanding intense heat, early experiments with rockets and rocket fuels probably would not have been successful.

With the development of the ablative heat shield, ceramics has reached its apex in performance. The quartz ablation shield used on the nose cone of the Intercontinental Ballistic Missile (ICBM) behaves in much the same manner as the epoxy-filled fiberglass honeycomb ablation shield of the Apollo Command Module. In both instances the ceramic materials (quartz on the ICBM – fiberglass on the Apollo Command Module), because of their ability to withstand intense heat, are contributing to space technology.

Ceramic materials are found wherever you travel around America's Space Port. Massive use of concrete – a ceramic material – is involved in the construction of the launch pads for the Saturn tests and ultimate Apollo flights. Huge channels below these pads are lined with fire brick. These assist in carrying away the intense heat of combustion during the first moments of takeoff when there is no motion to assist in heat dissipation.

Less spectacular but of equal importance has been the development of ceramic materials capable of being bonded to thin metals to line the exhaust chambers of jet- and rocket-powered engines. It is quite possible that without such materials, we might not have been able to conduct the experiments preliminary to the space effort.

(8) Wood: Since not one piece of wood equipment will go to the moon, with the possible exception of a wood handle on the geological specimen pick or a balsa cover on instruments, it would seem that woodworking was being phased out completely. Many industrial arts instructors are in accord with this implication.

For better than half a century woodworking has been the backbone of industrial arts. It has been exploited almost to the exclusion of other industrial processes. According to the most recent surveys, it is still being carried on in the majority of the nation's industrial arts laboratories, but it is being de-emphasized wherever revision of the program is underway.

This would seem to be in keeping with space technology, judging by the preponderance of other materials being utilized. However, on close investigation it is discovered that woodworking is still the "backbone" of the space industry. The Kennedy Space Center is the country's space port. It is here that space technology pays off. The space probes and moon missions depart from here. Behind these final stages are literally thousands of manhours of preparation. Still further, behind these takeoff preparations are millions

of manhours of experimentation, research and development and fundamental material manipulation. Primary in all these experiences is the involvement of wood technology.

To prepare astronauts for the lunar journey, NASA has constructed a number of simulators. In the simulators are embodied the ideas, skills and knowledge of an army of engineers, scientists and other technologists.

To simulate is "to assume the appearance of, without reality". This is exactly what the manned space flight simulators are designed to do. The pilots are made to feel that they are on an actual space mission. In this way also techniques and equipment are developed for reliable operation in space.

Without such models and simulators, the progress of research would be greatly hampered. The cost of such research and development would be prohibitive for even such a nation as ours if simulated conditions and equipment were not employed. In space technology, wood technology has risen to a height never before experienced. The finest wood craftsmen and the most highly-developed skills in wood fabrication are found in space technology. Truly, wood and all that the wood area implies is the "backbone" of space technology.

It should be pointed out that NASA is not advocating a space industrial arts course. It is suggested that the teachers teach the concept of American industry as it relates to our society today.

A study of the chemical, iron or aerospace industries, to name a few, is a fascinating and rewarding experience for both students and teacher. A typical outline for such an activity is as follows:

(1) Origin and background of the industry
(2) Organization
(3) Products
(4) Processes
(5) Materials
(6) Occupations
(7) Trends

NASA is happy to provide you with films, pamphlets, Tech briefs and other related educational material, all free of charge. To obtain these materials please direct your request to Mr. Harold Mehrens, Chief, Educational Programs Branch, John F. Kennedy Space Center, Florida.

Mr. Mehrens is Chief, Educational Programs Branch, John F. Kennedy Space Center, Florida.

DEVELOPING A GENERAL AERONAUTICS PROGRAM

Charles W. Swinford

I would like to preface my remarks this afternoon by saying that although the title of this session is "New Concepts in Aerospace Education", my report will be singularly lacking in new concepts and may even prove to have slighted some of the old ones.

The most radical thing that I have done to date is to propose that we include a course in "aviation" among our traditional industrial arts offerings, to write a formal course proposal and to pursue the matter for two years through inter-departmental meetings, curriculum committee meetings, administrative conferences and numerous private in-fighting sessions with the representatives of the status quo.

Early this fall, proposed curriculum changes were again presented to the curriculum committee and at this time our aeronautics course was accepted. The Board of Education reviewed the committee's decision, OK'd the budget, and authorized the inclusion of this course in the curriculum of the three Niles township schools, beginning with the North building, in the 1968-69 school year. As the initiator of this program, the responsibility for its implementation now rests on my shoulders.

As this will be my first attempt at such an undertaking, I do not come here as a purveyor of aviation curriculum blueprints which are guaranteed to fly, nor do I consider myself to be in a position to offer many blue-sky innovative ideas for doing something which I have yet to do the old way.

My intent is to report what we have done, are doing and hope to do with our program at Niles North.

The course proposal

There are probably as many formats for the presentation of proposed curriculum changes as there are schools with curriculums to change. While we were allowed considerable latitude, we did reply to nine basic questions. These questions, answers and, in some cases, the reasoning behind the answers, are as follows:

(1) What is the course title?

Aeronautics I & II. This title was selected because, although it is synonymous with "aviation", it seems to have more "status" value. We are an elective course vying for the students' time in a college preparatory-oriented school. We must sell our program to both students and parents.

(2) What is the length of the course?

Aeronautics I & II will last two semesters. Classes will meet three days per week for a 40-minute period. Twice a week the class will have a laboratory or double period of 80 minutes.

(3) What are the course prerequisites?

Enrollment is limited to the three upper classes, with seniors having first preference, juniors second and sophomores third. (As yet we have set no requirements which would tend to screen out the industrial arts majors. However, we have suggested to the guidance department that aviators must also be good with their heads.)

(4) What segment of the student body will this course serve?

By tradition, industrial arts students are mostly boys. We assume that this trend will continue. However, we are encouraging all interested girls to enroll. As a result of an interest survey taken earlier this year and next year's registration figures which are beginning to be compiled, we find that we are attracting students who have never before taken industrial arts courses and in numbers which we cannot yet handle.

(5) Are textbooks available for the course?

Yes. We are planning to adopt as our primary text An Introduction to General Aeronautics by C. N. Van Deventer, published by the American Technical Society. Several supplementary texts are under consideration, as are materials from both Sanderson Films, Inc., and Link Group, General Precision Systems, Inc.

(6) Are qualified instructors available for this course?

Yes.

(7) What preparations are necessary prior to offering the course?

A. We must prepare a tentative course of study.
B. We must prepare a comprehensive budget.
C. A suitable classroom must be found and equipped.
D. Training aids must be secured, examples of which are:
   1. operable engines
   2. "cut away" reciprocating and gas turbine engines
   3. airframe structural components
   4. assorted instruments and aircraft hardware
   5. charts, drawings, projectuals, movies and other visual aids.
E. Preparations for the flight experience unit must be made with a local fixed-base operator.

(8) What changes in the total school program will this course bring about?

We foresee no scheduling problems other than those which already exist with lab classes in a nine-period day. The course will add to the selection of elective subjects available to the student body.

(9) Why is this course necessary?

During the last 65 years we have seen the transition of powered flight by heavier-than-air vehicles start with the Wright Brothers' 120 ft., twelve-second effort and progress through non-stop, 600 mph commercial flights of several thousand miles.

The airplane has evolved radically during this time. From approximately 600 lbs. of wood, wire, fabric and gasoline engine, the Wrights assembled a powered box kite – a far cry from today's jet airliner. Still the airliner, jet fighter, helicopter and small private plane can all trace their lineage back through Orville and Wilbur's bicycle shop.

The hostilities in Europe in 1914-1918 saw the role of the airplane change from that of reconnaissance and artillery spotting to use as a tactical weapon. Since that time we have witnessed the gradual emergence of air power as the measure of our armed might.

The airplane, which has proven so valuable in two world wars, Korea and now in Viet Nam, is, however, no longer our primary defensive weapon. Our national security now rests on the ability of our aerospace industry to produce operable inter-continental ballistic missiles and anti-missile systems as well as the more conventional weapons platforms.

Within the last 20 years rockets have assumed an important scientific role in addition to their military applications. Our efforts in the exploration of space have reached the point where we no longer question the feasibility of sending men into orbit or off to the moon. The novelty of the "lift off", orbital flight, the walk in space, soft landings on the moon, etc., is virtually gone. These are now an accepted thing, "old hat" to a population that has seen more technological advances in the last 75 years than have taken place since the beginning of recorded history.

From the standpoint of economic importance to our country, the aerospace industry including civil and commercial aviation, represents a multi-billion dollar investment. This industry is one of, if not the, largest employers in the country. We have hundreds of thousands of people engaged in a multitudinous array of technical occupations within the aerospace labor force.

Quite understandably, with rapid advances in technology and expansion of the industry there are many unfilled jobs. There is now an acute shortage of some of the technical specialties, such as mechanics, pilots, technicians and engineers, and as "the state of the art" advances, new positions come into existence for which there are no trained personnel. In short, the demand for qualified people far exceeds the supply.

What do we hope to accomplish with our aviation program? We believe that the study of aviation has a place in the general educational program of our students at Niles. We are not attempting to make anybody into anything. We are trying to provide those experiences which will accomplish the following objectives:

(1) Although there is no way to teach it or test for it, we hope that our students will develop a more mature attitude, a sense of responsibility and a seriousness of purpose which is necessary for the long-term survival of those who fly.

(2) We hope to develop an appreciation for precision equipment and craftsmanship.

(3) We want our students to be fully aware of their environment – from sea level plus one.

(4) We hope to develop within the student an awareness of and appreciation for the progress which has been made in fulfilling one of man's oldest dreams – flight.

Mr. Swinford is Industrial Arts Instructor in Niles Township High School, North Division, Skokie, Illinois

F-15.12 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION OF THE SLOW LEARNER IN INDUSTRIAL ARTS
Chm., Herbert Wilson; Rec., James Hastings; Speakers, Charles Kokaska, William Cochran, Thomas J. Brennan; Host, Myron E. Lewis.

THE SLOW LEARNER IN INDUSTRIAL ARTS

Thomas J. Brennan

A number of you have participated in several sessions on this topic during the last two days. During this time our speakers have talked with you about methods, curriculums, and today, about evaluation in this newly emerging area. It is not my purpose to duplicate what has been said. It is also most difficult to be the last speaker in a series such as this and not duplicate anything which has been said previously. However, I shall do my best not to be too redundant in my summary and interpretation of what has gone on before.

This area is a fast growing one. This does not mean that it is a new one for industrial

rts teachers. Slow learners have been our lot from the time of Calvin Woodward but we ave not always welcomed them. "Industrial Arts as a Dumping Ground" was the topic f discussion at more than one American Industrial Arts Association Convention. Ericson evoted a chapter to it. More journal articles have been written on it than on almost any ther topic. I am implying that it has been just recently that we have finally come to the eluctant realization that we probably will always have these students in our laboratories nd it is time for us to make a serious effort to provide special programs for them. It ras just for this reason that West Virginia University last year applied for and was warded an NDEA Institute in Industrial Arts for the Mentally Handicapped. You have heard rom several of the staff of that Institute as well as from a number of participants.

West Virginia University had felt that the problem of the slow learner or the mentally andicapped student was extremely important and had, for a number of years, offered ourses in Industrial Arts in Special Education. We had had some success in this eneavor and had been asked to present a session on the topic at the convention in Washingon, DC. We felt the presentation was politely received but it had made little impact. Ve did not realize how much interest had grown until we started to receive applications or the NDEA Institute. Our eligibility requirements were such as to keep us from having ne wholesale appl' ation deluge which some institutes received. Nevertheless, we did eceive so many tha: we were hard pressed to read and evaluate all of them. We interreted this interest as an indication of the extensiveness of the problem and many instrucors were interested in doing something about it.

This has not always been the situation. We have personally received numerous letters rom honest, sincere industrial arts teachers who felt we were perpetuating the dumping round appellation. They strongly urged us to forget it and turn our efforts to more productive endeavors. On one occasion, one of our doctoral students, developing a research esign on this subject for his dissertation, could find so few teachers willing to be identified with the problem and to assist him in his study was forced to abandon the idea. The eception which this series of discussions has had is indicative of the change in profesional attitude we are experiencing. It would appear that more and more of our men are ealizing that industrial arts has a unique contribution to make and are attempting to do omething about it.

From the vantage point of experience, I should like to spend my remaining time discussing some points which I consider important for anyone to have in mind who is planning on entering into this area. Some of them have already been mentioned and so this will erve as a summary. They can also be used as evaluation criteria for programs curently in operation.

I will begin with several items which have particular reference to the elementary rogram. At this level the activities are really not industrial arts but actually crafts ctivities. An attempt is made to introduce the child to the world of materials around im. The activity should be part of the total learning experience and not an isolated one. We do not appreciate the teacher who says "Now we will do crafts." This kind of activity s usually an attempt to relieve tension or to provide recreation and relaxation. While hese objectives are important of themselves we prefer to think of the crafts as an integral part of the learning experiences. In fact, we have seen it function as the core round which the entire educational program was built.

Criteria for selection or evaluation at this level should include:

1. The craft should be <u>simple</u> enough to be learned. This implies that it should be within the ability of the learner.
2. The craft should be <u>useful</u>. It should produce a product which the student could use or could give as a gift. Exercises may have some value to the learner but this value is greatly enhanced when it culminates in something of value to the child.
3. It should be capable of being done <u>out of school</u>. This permits a longer exposure to the learning situation, provides for home activities and helps to relate the home to the school. Where retarded students are involved this is important to the total learning experience.
4. It should be a step toward learning a more involved activity. Often a child who is slow, or retarded, also has a problem of physical coordination. A simple manual manipulation learned well may become the foundation for better physical coordination required by a more involved craft.
5. It goes without mention that the craft should be of interest to the child. This is not at all difficult since at this mental and physical level exploration is the chief means whereby the c'ild learns. His interests are so widespread that a creative teacher

has little difficulty in discovering his chief interests, or in developing them.

6. The craft should be <u>challenging.</u> Once a student has learned an activity and has ex perienced success in doing it, he very often wants to do it over and over again. H hesitates to explore new directions where he might fail. This should be avoided an his interest developed toward the more challenging new activity.
7. It should involve as many <u>concomitant</u> learnings as possible. Crafts done for craft' sake alone has limited value. When they are used as a method of instruction or a a means of integrating academic skills their value is unparalleled.

<u>At the intermediate level</u>

1. The industrial arts activities, and at this level they should be industrial arts activities should provide for <u>successful</u> learning activities. If there was this value alone to th activity, it would be justified. However, at this level, the student has very often ha few successful learning experiences. He is often disenchanted with school. The in dustrial arts laboratory, the physical education program and perhaps one or two othe activities provide the only educational oases in the desert of the academic program
2. They should introduce the student to the <u>world of work</u>, so that he might begin to thin of a future occupation. This is often his only occupational orientation. For thes students vocational emphases are entirely proper. We must re-orient our thinkin from the strict general education aspect and think in terms of what is best for th student.
3. Individual instruction, as much as possible, is a <u>must</u>.
4. Adherence to a work schedule as a prelude to employment is enhanced through indus trial arts activities. The shop organization plan, mass production activities an similar endeavors aid in this objective. Very often the attention span is short an interest is flighty. A teacher who is strict, but human, is the best help these student can possibly have.
5. Home mechanics is an excellent activity for this level.
   a. It provides a possible source of income for the "fix-it" student.
   b. Students become involved in homemaking activities which is important for thei ultimate roles as home makers.
   c. It provides an excellent activity for group work for the development of inter dependence.

<u>At the advanced level</u>

At this level the industrial arts – vocational program is often divided into the pre vocational and the diversified occupation programs. The former is properly the responsi bility of the industrial arts teacher. The latter should be handled by a vocational teache who is specially trained. Here again the chief objectives are:

1. Prevocational in nature – occupational information on unskilled or semi-skilled occu pations.
2. Group activity centered for the development of this important attitude.
3. Emphasis should be placed on personal economics as opposed to industrial economics
4. Mass production activities seem to provide the best approach to gain these objectives

In conclusion I should like to make one salient point. Although these students, on the basis of past performance, have not come up to standard, please do not sell them short Neither has our work with them come up to standard. When special programs are pro vided, teachers are sympathetic (and not overworked), when they have some knowledge of how to attack the instructional problems, these students have responded to an amazing degree. I would like to illustrate this fact by telling a rather amusing story, which upo analysis, points this up quite vividly.

Some of you may be old enough to remember the time when the "moron" storie were all the rage. Well, this is a story about a moron carpenter. It seems that help wa extremely hard to come by on a certain large scale building project when thousands o small homes were being built. This particular carpenter had been working for a long time, was well liked by his fellow workers and in general, had been a satisfactory work- man. Because of the shortage of supervisors, it was decided to make him a foreman and put him in charge of a crew which would work more or less independently, with only occasional visits from the project supervisor.

The crew went to work and for several days there was considerable activity. The supervisor was too busy to do much more than look over to the place where this house

vas being erected, but everything seemed to be going smoothly. He was understandably ;urprised one morning to find the moron carpenter and his crew waiting to see him at his ield office. After the usual amenities were passed, the carpenter, obviously agitated, ›lurted out. "Say Boss, do we start these houses from the top-down or from the bottom-ıp?" The boss replied in no uncertain terms that "any blankety-blank fool knew that they ıad to be started from the bottom-up." To this the carpenter replied, "Well boys, I guess ve'll just have to tear it down. We did it wrong."

Dr. Brennan is Coordinator of Industrial Education at West Virginia University, Morgantown.

OUR EXPANDING RELATIONSHIP TO SPECIAL EDUCATION

Charles J. Kokaska

In this presentation, special education will refer to those programs that have been established within secondary schools for the educable mentally retarded. The chief characteristic of members of this heterogeneous group is that at some point in their secondary school careers they recorded between a 50-85 intelligence quotient on an individual intelligence test. Other than this factor, members of special classes demonstrate considerable variance in social, psychological, academic and vocational ability.

Curriculum Objective

Since the late 1930s, the main goal of secondary classes for the retarded has been occupational training, placement and success. Indeed, those of us who train prospective teachers and assist in curriculum design focus on the implementation of this goal from the primary through secondary grades. The realistic planning that we envisage and engender for the retarded essentially rests upon whether the individual will be employed when he completes his education.

However, it is not enough for us just to think about getting jobs for our students. We must also consider the relationship of the individual's skills to conditions within the competitive labor market. It has been our experience that members of this educational group often occupy a marginal status within that market.

"Marginal status" is defined as employability rather than racial, intellectual, emotional or economic indices. It is directly related to the maintained potential for being employed and the level of occupational skills. Factors such as race, intellectual ability and emotional status do have a bearing upon the employability of an individual. For example, one of the main points made by recent civil rights protests is that inadequate education associated with urban ghetto schools is one of many factors contributing to the disproportionate percentage of unemployment among Negro males as compared to that of white males. Marginality in the labor market is applicable not only to the mentally retarded, but also to members of other subgroups within the socio-economic structure who encounter conditions and factors which ultimately result in lower rates of employment and lower levels of occupational skill.

Occupations for the Retarded

In 1967, Kokaska completed a national survey of secondary urban programs which included the occupations at which the retarded were being trained and placed.(1) Only the occupations in the craftsman and operative areas are included below.

An Abridged List of Occupations in Which the Educable Retarded are Being Trained and Placed by Secondary School Systems

Craftsmen

appliance repairman	body-fender repairman	carpenter's assistant
auto mechanic	book binder	carpet layer
baker's assistant	bricklayer's assistant	carpet layer's assistant
bicycle repairman	butcher	cement finisher's helper

dental assistant
electrician's assistant
furniture repairman
house painter
meat cutter
monument engraver
mortician's assistant
photographer's assistant
plumber's assistant
printer's assistant
radio-TV repairman's assistant
roofer
saddle-bootmaker
shoe repairman
sign painter
sign painter's assistant
tailor's assistant
TV cameraman
tool shop apprentice
house painter's assistant
lens grinder
machine serviceman
upholsterer's assistant
welder
woodcutter

Operatives

drill press operator
fork lift truck operator
laundry-dry cleaning machine operator
milling machine operator
sewing machine operator
staple machine operator
truck driver

Assembly worker in:
- air conditioner factory
- auto parts factory
- candy factory
- electronics factory
- food plant
- furniture factory
- garment factory
- greeting card factory
- pen-pencil factory
- sheet metal factory

In glancing over the various job titles, one may be surprised at what the retarded are able to do. One must recall that we are working with a group that demonstrates an array of differences and therefore we must be cautious in characterizing them according to stereotypes we may have acquired from newspaper articles or television specials.

Lawrence recently completed a survey of secondary programs in the five counties surrounding Detroit in order to probe some of the results from Kokaska's national study.(2) He chose the Detroit area because of its concentration of industries and the opportunities this affords special class students to enter diverse occupations. The following is an amplification of two job titles in the operatives area taken from the survey

Selected Operative Occupations

Title	Duties	Range in Hourly Wage Rate
Assembly worker in auto plant	spot weld paint grind metal final assembly finish and trim	$2.75 - $3.40
Machine operator in smaller firms	repair and clean machine operate drill press grind gears operate radial drill buff metal plate metal parts	$1.70 - $2.50

One may ask the question: "Are these jobs consistent with what we know about retarded who have been in the community for several years?" My response would be "Yes!" Various follow-up studies of former special class students have indicated that as high as 16.0% to 32.6% of the survey populations have entered skilled occupations after 10-15 years in the community.(3) These various follow-up studies also denote that a great deal of vertical and/or horizontal vocational mobility is possible when students have been given the benefit of special education and training in addition to economic opportunity within the community.

Conclusion

Based on this information of our students' abilities and achievements, you may understand the reasons for emphasizing the extension and expansion of cooperation between the

ndustrial arts and special education. We certainly have common goals, and there are xamples throughout the nation's secondary school systems which indicate that these oals can be achieved. For example, in the Phoenix (Arizona) Union High School System, tudents are placed on part-time work experience during their 11th year. In his subse- uent employment evaluation, the work-study coordinator has often received suggestions rom employers relative to skills the student may learn that would help him advance on he job. Buttressed with these suggestions, the coordinator is then able to approach mem- ers of the industrial arts department in order to gain specific training along the lines f the employers' suggestions. In this instance, each area contributes to the appropriate unction of the other and enhances the student's eventual vocational success. This, in the inal analysis, is our common goal.

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PROGRESS IN OCCUPATIONAL SKILLS FOR THE MENTALLY RETARDED

William A. Cochran

Devising fair and useful means of evaluation gets steadily harder. School systems group children by ability; classes no longer represent an average distribution of ability and yet each parent has a right to know where his child stands in each of the skill areas of the school program.

This is true for the parent of the mentally handicapped child as well as for the parent of an average or above average child. The anxiety of the parents of a retarded child requires that they receive some specific information on the progress and growth of their student even though the child's abilities are limited.

Parents are usually familiar with the standard letter grades. They know that A, B, C, D and E stand for objective standards. But what does a C really mean? In most school systems it means average progress in relation to standards or norms that have been established in a school system or on a nation-wide basis.

It is unfair to compare the mentally retarded student with other students on a school system or a national basis. It is already known where they stand – at the bottom of the learning curve. Therefore, de-emphasize reliance on national or system averages as grading criteria for the mentally retarded. Any system of evaluation for the mentally retarded should reassure parents that their child is being evaluated as an individual and not on the basis of a comparison with the normal school population.

One of the characteristics of the mentally retarded is that they show steady growth and development but at a much slower rate than the normal person.

A possible solution to the problem of evaluation would be to lower the percentages so that 40% would be the mid-point for a C. But can this be a solution when we are still using the norms of the normal population as a criterion for evaluating the mentally retarded? What instruments of measurement could be used to arrive at a percentage score? The limited reading ability of the retarded eliminates written tests. Some thought could be given to oral tests, but many times a retarded student will not answer because past experiences have proven that he was wrong and he hesitates to answer verbally.

There is a method of evaluation developed by the MacDonald Training Center Foundation in Tampa, Florida, which has some merit and has been used in a school system with some success.

The Work Habit Rating Sheet, developed by the MacDonald Training Center, divides student's progress into four skill areas:

(1) Learning and comprehension, encompassing response to instruction, concentration and adjustability to new job tasks.
(2) Performance, encompassing frustration tolerance and consistency of effort.
(3) Attitudes towards work, encompassing adaptation to work environment, motivation to work, reaction to pressure, punctuality and work interest.
(4) Interpersonal relations, encompassing reaction to supervisor, cooperativeness with supervisor and relationships with peers.

Each skill area is subdivided into traits or skills which are given a weighted value from 1 to 4. The teacher circles one trait under each skill and the total is recorded at the end of the sheet. If a letter grade is desired, then it is a simple matter to convert the raw score into a letter grade.

The entire sheet can be sent home as a report card. The rating sheet hopefully is a step in the right direction. It is subjective and teacher-opinionated but good until a better method of evaluation is devised.

Employer's Report to Coordinator

The Arlington County Public Schools use an additional evaluation form titled, Employer's Report to Coordinator. The George Mason Occupational Training Center strives to develop mildly retarded young adults into competitive employees, but also places and follows up the trainees for a period of three years after completion of their formal education. The rating factors used are enthusiasm and interest in job, attitude, cooperation, initiative, reliability in following instruction, dependability, production and quality of work. These factors are evaluated under outstanding, excellent, very good, good, adequate, fair, unsatisfactory, very poor and irremedial. The Job Coordinator, who spends one-half of his time in the classroom and one-half in the field of job procurement, uses this form for evaluation and follow-up.

Conclusion

The mentally handicapped student does show steady growth and development, but how to evaluate him is just another of the many problems already encountered by his teacher.

Yet people are evaluated every day on the job and in the community without the use of percentages or letter grades. Therefore, de-emphasize reliance on national or school system averages as grading criteria for the mentally retarded. Instead, use work habits, attitudes and other temperamental traits that are necessary for success outside of the school environment.

When any student leaves school he is judged and evaluated by his function and performance in his daily living and not by the letter grades he received in school.

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F-15.13 AIAA
Special Interest Session
NEW CONCEPTS IN THE EVALUATION AND THE IMPROVEMENT OF INSTRUCTION
Chm., Dan Householder; Rec., George W. Barnhardt; Speakers, Warren Olson, Paul T. Hiser, Bill Wesley Brown; Host, Perry G. Rawland.

IMPROVING PRACTICES IN MARKING AND REPORTING

Paul T. Hiser

Does a report card with a mark of "B" in "shop" carry the message about the pupil and industrial arts that we desire? For a number of years considerable concern has been occurring within the teaching profession regarding the need for educational institutions to

nprove the evaluation of pupil progress and the reports to parents of students relative › their achievement.

Most experimentation in marking and reporting has occurred at the elementary level ainly because high schools endeavor to conform to a marking system that communicates cademic achievement to institutions of higher education. Wilber and Pendered (11, 254) advise that grades in industrial arts have been determined largely from appraisal ' skill development from project making and written tests.

Three aspects of marking and reporting to be considered in this presentation are:) some essential criteria leading to possible improvements, (2) to suggest some newer rocedures for industrial arts and (3) possible resulting outcomes for students and in- ustrial arts.

Measurement is the process of securing quantitative data, while evaluation is more iclusive, obtaining a judgment qualitative in character and usually encompassing many inds of evidence. Marks resulting from this process of evaluation promote optimum de- elopment of the student in the broadest sense. Primary to this proposition is the student ather than teacher or parents. Research reveals the past forty-year trend has been way from percentages to letter grades and more consideration of personal and social raits of students.

Criteria for Marking and Reporting: For future efforts in marking and reporting ractices, some basic questions, based upon similar elements and guidelines taken from number of valuable studies (12)(3, pp. 15-24)(4, pp.306-443)(6, pp.372-381)(1, pp.521- 55)(10, pp. 236-267), should be answered:

(1) Educational Objectives: Have educational objectives been clearly identified and xpressed as desired pupil behavior promising educational outcomes? Are they under- ood and accepted by students, teachers and parents?

(2) Marking and Reporting System: Has the plan been cooperatively developed with ie participation of teachers, administration, students and parents in keeping with the edu- ational philosophy of the school? Does it provide the information needed by the pupil, arents, counselor and others and assist the student in self-evaluation of his own progress oward worthwhile goals?

(3) Bases for Marking: Have the bases for marking been made clear and can ap- raisals be supported by adequate evidence? Are there provisions for recognizing and iarking separately factors other than academic performance, such as social responsi- ilities, work and study habits?

(4) Report Forms: Can the report forms be employed with a minimum amount of me and clerical work? Are the symbols used meaningful to all persons who have need or them?

These criteria, by no means intended to be all-inclusive, can, if accepted, be useful s guides for marking and creating a report form.

Defining Objectives Clearly: Critical among the criteria for any marking and report- ig system are those related to the choice of objectives and the manner and clarity in hich they are expressed for guiding the instructional program. Ebel (4, p.30) comments, The failure to define objectives in terms of student behavior probably accounts for much f the inadequacy in evaluation of student progress in schools and also for the very poor uality of many classroom tests.'

Goals of education stated as desired behavior have been produced by Bloom, Krath- ohl, Masia (2)(7), French and associates (5) and Mager (8). These recent resources are aluable for educators concerned with preparing more meaningful educational objectives. mproving marking and reporting practices depends significantly on what is being meas- red or evaluated in an objective manner. Clear goals are essential to this process. With- ut them the teaching effort can be lacking in relevance. Marks that do not reflect how well oals have been achieved by students or reports to parents that fail to communicate either ne goals of the school or achievement raise serious questions about the appropriateness f the entire process.

Editors Thornton and Wright (9,p.33) provide helpful suggestions about preparing oals that include types that are both general and specific. As to writing goals for a sub- ect area, the authors advise that an objective, to be in proper form, "must contain two iajor parts: a kind of learning and a subject matter content."

Apply these criteria to a general purpose of industrial arts, widely-accepted, "has n insight and understanding of industry and its place in our culture". The words "insight" nd "understanding" identify the kind of learning, while "industry" and "its place in our ulture" specify the content area.

Obviously this is a comprehensive goal and can become operational in the classroo[m] only when more specific goals are carefully drawn that identify learning products expecte[d] and the clues for what to evaluate. If helping students to understand industry is a gener[al] purpose, one related specific goal could be: "Possesses knowledge of the functions of th[e] personnel division common to most manufacturing industries."

Marks – Their Meaning: A single mark used as a composite of achievement (academic, personal, social) should be avoided. Most authorities would agree that a singl[e] mark should represent competence in subject matter only, not combined with effort o[r] personal or social traits. These traits should be reported separately as outcomes i[n] addition to academic skills. The reporting system should make interpretations clear t[o] students and parents.

Improving Practices in Industrial Arts: Industrial arts offers many opportunities fo[r] evaluating pupil growth and development, including verbal-literary competencies, technical skill, problem-solving, pupil traits, etc. Yet procedures employed are often to[o] limited, or if evaluations synthesize several objectives they go unnoticed. More seriousl[y] they are not communicated to parents and others. Improvements can occur by (1) expressing goals of instruction found in many current programs in keeping with accepted principles and (2) developing report forms that communicate more meaningfully and completely the instructional program and the progress of students in terms of these goal[s].

The seven objectives listed on the following report form are believed common t[o] many programs of industrial arts. Each school, of course, must develop its own objectives and report forms consistent with its philosophy and local circumstances.

Outcomes: Effective report cards can convey thousands of messages each year t[o] students, parents and others, thereby creating a positive impact upon the image of industrial arts and its contribution as a part of general education.

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------- SCHOOL -------
Report of Achievement and Progress in
Industrial Arts

tudent: ______________________________ Date of Reports: ______ ______ ______
Last name First 1 2 3

valuations on this report are made in terms of the objectives of the course of industrial rts as indicated below. The appraisals are based upon what might be expected of students f similar age and grade placement. Personal conferences are encouraged if further nformation is desired.

ndustrial arts, a part of the total school program, is concerned with the study of industry ts organization, tools, processes, occupations, problems of industry, and influences on aily living. The purposes are to assist students in better understanding technology and o encourage the development of practical and technical talents.

Meaning of Symbols Used for Evaluation

A - outstanding progress
B - very good progress
C - average progress
D - minimum progress, improvements needed
E - unsatisfactory progress
NE - not evaluated, insufficient evidence

* * * *

OBJECTIVES	Periods 1	2	3
. Planning: prepares adequate drawings, computes costs of materials, and outlines major steps anticipated in carrying out problem to completion. ---	B		
. Technical Skill: uses tools, materials, and equipment in a safe manner and demonstrates good workmanship. ---	A		
. Communication Skills: employs in written work correct spelling, technical terms, and good form permitting communication to others. --	C		
. Knowledge and Understandings: from tests evidences knowledge of facts and principles related to tools, materials, processes, and understandings about the major aspects of the organization, operation and influence of industry. --	B		
	86		
	Letters and Percent		
Composite Mark in Subject ---			
Personal and Social Work Habits			
5. Cooperation: displays a willingness to cooperate with people and to share in activities of mutual concern to others. ---	B		
6. Use of Time: works to the best of his ability employing his time effectively with a minimum of supervision. ---	A		
7. Dependability: can be depended upon to meet obligations and to persist in overcoming problems in completing work assigned or self-assumed. ---	A		

Comments: ____

Form by P. Hiser
4/68 - Oswego

____
Instructor

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CRITICAL CONCEPTS IN EVALUATION

Bill Wesley Brow

The title of this special interest session – "New Concepts in the Evaluation and Improvement of Instruction" – implies three fundamental ideas. First, instruction is goin to be evaluated, and, second, instruction is going to be improved. The third implicatio is that new concepts or truths have been discovered. At first glance, it seems we ougl to be able to say: evaluate, apply, improve. To the professional, however, this simplification is an insult.

At a time when the education dollar is being scrutinized more carefully than at an other time in our history, people are looking more critically at the quality of instructio at all levels. The question that persists in the minds of those who want to evaluate instruction carefully – whether they be laymen or professionals – is: since no two peopl are alike, how do we evaluate the job of teaching that they are doing?

Several assumptions will make our task easier. Let us assume that teaching is th process by which changes in behavior are effected in an individual.

Let us assume that teachers as well as students will also change.

Let us assume that teaching can take place in a school – but that it is not limited t the group of buildings known as a school.

Let us assume that a teacher has an inner drive or determination to excel.

Can we now identify any new concepts in evaluation that will assist us in our determination of quality instruction? Specialists in evaluation on our campus indicate that change in emphasis in evaluation in general has in fact taken place. A trend has develope that can be identified as evaluation before the fact, rather than after the fact. The need of the individual have become of primary importance. In terms of the student, this woul mean a pre-test to ascertain a level of skill, knowledge, relationships and so on. We woul identify and record his present behavior patterns. In terms of the teacher, and by extrapolation, this could mean a test before being hired, followed by tests at certain predetermined places in the career of the teacher.

Is this not what we do already? We don't call them tests, but in reality the results ar precisely the same. We examine the credentials and transcripts of an individual applyin for a position with our institution. If we approve, he has passed the test; if he fails, w have not approved.

To the supervisor who is wise in the ways of the academic world, this pre-test wil serve as warning. If the candidate, in spite of obvious weaknesses, is still the better c several alternatives, the weaknesses will become checkpoints for both teacher and supervisor to mutually try to strengthen. This then makes the trend reasonable. Far better t assist and help during the year than to watch, record and murmur about the poor job th teacher is doing in one or two areas. Two things have resulted: one, the students hav struggled to learn under adverse circumstances, and two, your district has lost a teache about whom someone thought enough to hire.

Just as a teacher must encourage a student to appraise his own work independentl of other students, a supervisor must encourage a teacher to evaluate his work independently of other teachers.

The job of the evaluating supervisor is further confounded by minimal expectations What is barely tolerable for A may be outstanding for B. Yet the counterparts of thes two can be found in the same district and building.

One trend that my colleagues did not report but which personal contacts have tende to substantiate is the trend toward making the principal of a secondary school the chie supervisory officer of his school in fact and reality and not just in name and theory. Whe the principal, by reason of his academic preparation and his years of experience, ca evaluate instruction and take time to offer valuable recommendations to teachers – especially first-year teachers – we have indeed rediscovered an old concept. Some supervisors, department heads and senior classroom teachers have been doing this for years others will need to discover this "new concept" all over again.

In conclusion, the following comments seem appropriate:

(1) If we want to evaluate instruction and bring about improvement of instruction, w must inescapably evaluate teachers. Most supervisors and administrators agree that w cannot wait until a teacher's students have graduated and are found to be successful o unsuccessful in their chosen endeavors. (Some people would say that a former studen

ho worked all his life and then retired had led a successful life, while another would say ıat a former student who worked only part of his active life and then retired with an inadequate income had led an unsuccessful life. In either event, it is a bit late to correct ıe deficiencies of the teachers in either case.)

(2) Most professional industrial educators have long agreed on certain principles to se in evaluating students' achievement. Parallel principles can be used in evaluating the nprovement of instruction: evaluation should be continuous, objective, fair, timely, ystematic, announced and unannounced and thorough. Psychologists indicate that our re-tests need to be more sophisticated as we select our colleagues. Experience indiates that professionals are now being given the time to carry out supervisory duties of significant nature.

The result of such efforts will be effective instruction and the improvement of intruction. Just as students acquire – under able teachers – new concepts, insights, skills nd knowledge, so teachers can acquire greater competencies which will benefit all conerned. Further, these behavioral changes have been realized through a team effort. The alue, worth and dignity of the individuals involved have been enhanced rather than iminished.

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-15.14 AIAA
pecial Interest Session
JEW CONCEPTS IN THE EVALUATION AS TOOLS FOR THE IMPROVEMENT OF INSTRUCTION
:hm., Walter C. Brown; Rec., Dennis Steckelberg; Speakers, Carl G. Bruner, Clois E. Kicklighter; Host, Jan B. Eke.

EVALUATION

Carl G. Bruner

This paper is concerned with the values that accrue to the individual student through ı system of evaluation and/or grading. An attempt is made to answer the student's query, "What is there in evaluation for me?"

All things that exist, exist in quantity. Anything that exists in quantity can be measured. If a purpose or objective is identified and the starting condition or position of the ndividual student is determined, then the progress from where he is to where the teacher vants him to be can be measured and the result used for a variety of purposes.

Grades have been used as rewards for performance, attitude, cooperation, regular ıttendance, etc. Grades have been used for motivation. Grades have been used for ›unishment. Grades have been used as an indication of readiness to enroll in advanced work. Grades have been used as a basis for the awarding of diplomas, etc. Depending ıpon the student's expectations, any of these purposes might answer partially, "What is n the evaluation for me?" Unless these various reasons for raising or lowering the grade are "spelled out" in the objectives of the course, these uses for grades are quesionable, although it is not uncommon to find teachers using their grades for all of these ›urposes. The grade should show the progress toward the stated objective and should ıot be used for any other purpose.

Evaluation is an integral part of instruction. The teacher that wishes he could be ree to teach without bothering to measure pupil progress is not being realistic. The only way to judge the effectiveness of instruction is to measure the progress of pupils toward stated objectives. Such measurements should not be limited to cursory attempts to "test" the memory of pupils for certain facts or information, nor should it be limited to a judgment of the quality of one job or one project. Appropriate evaluation involves many subjective as well as objective observations designed to judge pupil knowledge, effectiveıess and understanding.

Progress toward an objective is continuous and cumulative. A mark denoting achieve-

ment level should indicate the level attained – not merely averages of past performance. If progress is measured toward a stated objective, the mark should reflect the student's proximity to that objective at the time of evaluation. This concept does not imply that the course grade should be entirely determined by a final examination. If progress is continuous and cumulative – evaluation must be continuous and cumulative as well. Improvement in the pupil's acceptance of a grading procedure can be achieved through frequent grading. Some teachers establish a daily rating card. At the end of each day each student knows the rating that he has received, and why.

It was stated at the start of this discussion that the grade was a measure or indication of the student's progress toward the goal set for the course – usually by the teacher. We would suggest that the student should be involved in the selection of the goal, the means used to assure progress toward the goal and in the evaluation of progress.

A student will derive personal benefit from a system of evaluation only to the degree:

--That he understands and accepts the evaluation methods as fair, reasonable, valid and reliable.

--That he is involved in the operation of the evaluation process.

--That he accepts the goals or objectives as desirable and worthy of his efforts.

More important than any material included in the course is the impact of the experiences in the class on the student's image of himself. All of us are salesmen. How well we sell ourselves to our associates, or how effectively we promote an idea depends to a large extent upon our own feelings of adequacy.

The importance of the "self image" can be illustrated by the use of a formula:

$$P = \frac{A}{I} \times (K + S)$$

P = Performance
A = Adequacy
I = Inadequacy
K = Knowledge
S = Skill

To illustrate the use of the formula, let's consider that a teacher wishes to "sell an idea" to the superintendent of schools. The teacher's knowledge and skill in the area are adequate. He is ushered into the superintendent's office. Perhaps he will feel nervous and a little afraid. He may feel quite certain that the superintendent will not like the idea, and that he will not "buy" the arguments that he plans to use. To use the formula:

$$K = \frac{2}{10} \times (10 + 10) \qquad K = 4$$

The same teacher with the same skill and knowledge is asked to present the same idea to his department head who is a personal frien , they like and respect each other.

$$K = \frac{10}{1} \times (10 + 10) \qquad K = 200$$

The only item changes in the two situations was the presenter's feeling of adequacy. His knowledge and skill did not change. His self-image was the variable. The result was entirely different.

What is there in evaluation for the student?

(1) An opportunity to analyze and accept the objectives, goals and purposes of the course.

(2) An opportunity to understand what constitutes progress.

(3) The frequent, perhaps daily, stimulation that comes from achievement.

(4) The opportunity to build a "self image" – a feeling of adequacy based upon a real knowledge of his own strengths and limitations, his own areas of effectiveness.

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EXCELLENCE IN TEACHING THROUGH TEST ANALYSIS

Clois E. Kicklighter

All teachers are or should be concerned with the problem of evaluating pupil progress and assessing teaching effectiveness. One of the most commonly used methods of evaluating pupil progress is pencil and paper tests. A teacher who plans to use a pencil and paper test is faced with such questions as the following which he must answer: "How many questions should I have on the test?" "What types of questions should I include?" "How difficult should the questions be?" A teacher should also be concerned about a number of other factors which relate to good test construction. These factors include:

(1) Relevance – Do the questions chosen reflect the material studied? Do the questions test desired achievements?
(2) Balance – Does the proportion of items dealing with various aspects of the material studied reflect intended emphases and accomplishments?
(3) Objectivity – Are the questions clear and concise or do they have ambiguous meanings?
(4) Difficulty – Is the level of difficulty of the questions appropriate for the group intended? The questions should be neither too difficult nor too easy.
(5) Efficiency – Is the format and design of the test such that it requires an appropriate amount of the teacher's and pupil's time? The time factor should not influence the pupil's score disproportionately to the objective involved.
(6) Discrimination – Do the individual questions discriminate sharply between students of higher and lower achievement, and does the test, as a whole, show overall differences in achievement which exist? This is a point of major importance.
(7) Validity – Does the test result in scores that agree with those obtained from equally good independent measures of the same achievement?
(8) Fairness – Is the test designed in such a way that each student has an equal opportunity to demonstrate his real achievement in the area concerned?
(9) Reliability – Does the test produce results which are consistent every time under the same conditions.

Unfortunately, it is rather difficult to analyze a teacher-made test without first administering it and therefore indicating the questions that are to be asked. Standardized tests do not have this shortcoming because they are pre-tested on a large number of students like those for whom the test is intended. Statistics are gathered on the success of the group with each item. Poor questions are then discarded in favor of the better ones. The quality of the question is dependent upon its discriminating power.

Teachers should analyze each test after it is given and gradually build up a file of test items that have discriminated well in the past. This procedure will enable teachers to design tests that qualify as "good" tests. The file of questions for a given area should be large, and records should be kept relating to frequency of use and discriminating power of the question. If this approach is followed, there is little chance of the test items' losing their effectiveness.

How to Analyze a Test

The simplest method of item analysis (question analysis) that teachers may use is the "show of hands" technique. For routine tests, the teacher might want to use this method. The procedure is as follows:

(1) Call out the items one at a time and ask who missed each item.
(2) Have each student who missed the item raise his hand.
(3) Count the number of students who missed the question.
(4) Record the count for each question on your test copy and indicate questions for discussion based on the count.
(5) Discard or rework questions which were missed or gotten correct by nearly everyone.

This method of analysis does not, however, tell the teacher which items are the best discriminators, but merely indicates the number of students who missed each item. Even so, certain deductions may be made from the simple data. If everyone answered a given question either correctly or incorrectly, it did not discriminate between those who knew

the subject matter from those who did not.

More important tests are usually analyzed using the "high-low" type of item analysi: This method indicates the discriminating power of each item as shown by the fact th: more high-scoring than low-scoring students got it correct. The procedure for using thi method is as follows:

(1) Select the test questions that fall in the top 27 percent and bottom 27 percent (the total. Use these two groups for the analysis.

(2) Tabulate the number of students who correctly answered each item in the "higl group".

(3) Tabulate the number of students who correctly answered each item in the "low group".

(4) Subtract the number in the low group who correctly answered each question fro the number in the high group who correctly answered the same question to obtai the discriminating power of the question.

It should be pointed out that an equal number of tests should be in the "high" an "low" groups. If one group should have more tests than the other group, then the analysi will [illegible] rsely affected.

Example of a high-low analysis:

Situation: A total of 20 students took a 10-question multiple choice pencil and paper tes The spread of scores on the test was as follows:

Spread of Scores

Top 25% Student	Top 25% #Correct	Student	#Correct	Lower 25% Student	Lower 25% #Correct
1	10	6	7	16	5
2	10	7	7	17	5
3	9	8	7	18	4
4	9	9	7	19	4
5	8	10	7	20	3
		11	7		
		12	6		
		13	6		
		14	6		
		15	5		

Question	Top Five Tests Correct Answer	Bottom Five Tests Correct Answer	High-Low Difference	Discriminatio
1	4	1	3	+
2	3	2	1	?
3	5	5	0	0
4	5	0	5	+
5	2	4	-2	–
6	4	3	1	?
7	5	2	3	+
8	3	3	0	0
9	5	1	4	+
10	5	3	2	+

\+ Acceptable discriminating power

? Positive, but questionable discriminating power

0 Did not discriminate at all.

In analyzing the results, you could use an approximate method of computing the acceptance level for each question. The procedure is to divide the number of students whc took the test by 10 and round to the nearest whole number. For example, if 20 students took the test, the minimum acceptable high-low difference would be 2. If an item exceeds this number, it may be considered an acceptable test item. If the high-low difference is less than the acceptable level, then the item must either be altered or discarded.

In the example presented, questions 1, 4, 7, 9 and 10 have a high-low difference o:

or above. They are acceptable test items. Question 4 is the best questic because all f the students in the top group got it correct and all of the students in the bottom group nissed it. Questions 2 and 6 were positive discriminators but not very strong. Questions and 8 did not discriminate at all, while question 5 was a negative discriminator. Question 5 did exactly the reverse of what it was designed to do. It discriminated against the tudents who really knew the material.

It should be pointed out that a further analysis should be made of the questions which id not qualify as good, strong, positive discriminators to discover why this was the case. Examine the answers given to see if a pattern exists among the students in the top group. This analysis should give direction in rewriting the question.

Test analysis will not solve all problems relating to testing, but it will provide information which is useful in improving your tests. Give it a try and see if you don't agree.

Dr. Kicklighter is Assistant Professor of Industrial Education at Eastern Michigan University, Ypsilanti.

ANNUAL BUSINESS MEETING

President Ralph C. Bohn called the meeting to order at 2:45 p.m. He introduced th Executive Secretary of the AIAA and called for the reading of the minutes of the previou meeting. Kenneth Schank (Wisconsin) moved that the minutes be approved as read, William Wilkinson (Pennsylvania) seconded the motion, and it carried.

The Executive Secretary then presented the financial report of the Association Copies of the report were made available to the Delegate Assembly. William Ka... (Pennsylvania) moved that the report be approved, Leslie Grigg (Iowa) seconded t... tion, and it passed.

The Executive Secretary further reported on the membership in the Association A drawing was made to determine Sweepstakes winners for 1968. Ronald Thomas (Wes Virginia) moved that the report be approved, James Music (California) seconded the mo tion, and the motion carried.

Dr. Ralph C. Bohn presented the President's Report. This report underlined the ke accomplishments of the Association during the past year.

Dr. Robert L. Woodward presented the report of the Resolutions Committee. Fiftee resolutions were approved individually. Several delegates moved that all 15 of the reso lutions be approved. Their motion was seconded by Louie Melo (California), and th motion carried.

The Business Meeting of the Association was adjourned at 4:00 p.m.

Respectfully submitted,
Howard S. Decker
Executive Secretary

TEACHER RECOGNITION AND OUTSTANDING TEACHER AWARDS

To: Executive Committee
From: Sherwin D. Powell, Chairman, Teacher Recognition Committee
Date: May 3, 1968

REPORT OF TEACHER RECOGNITION COMMITTEE

Members of Committee:

Jacqueline Killam	- El Rodeo School Beverly Hills, California
William B. Landon	- Department Chairman, Industrial Arts Englewood High School Englewood, Colorado
William Wilkinson	- Director of Industrial Arts Nether Providence High School Wallingford, Pennsylvania
Sherwin D. Powell	- Department Chairman, Industrial Arts William J. Palmer High School Colorado Springs, Colorado

AIAA State Repre ntatives, State Association Officers an Teacher Recognition Committees have coope ated with this committee to make partic on this year the b to date.

Report:

The num of awards presented this year and the past five years are:

1963 --- 21 awards
1964 --- 30 awards

1965 --- 30 awards
1966 --- 39 awards
1967 --- 44 awards
1968 --- 51 awards

All fifty states, Guam, Puerto Rico and the ten Provinces in Canada were contacted hrough their AIAA representatives.

All states except Alaska, Hawaii and Washington are participating this year. Only one Province of Canada (Ontario) is participating this year.

Plaques were sent for early presentations in the following states:

California	Indiana	South Carolina	Oregon
Colorado	Mississippi	Texas	

The Teacher Recognition Committee wishes to express our thanks to the members in each state who have contributed so much time and effort in making this program a success.

The chairman wishes to thank the members of this committee for their suggestions and assistance. He especially wishes to commend William Wilkinson for his excellent liaison with the jeweler in the preparation and delivery of the plaques.

The Teacher Recognition Committee wishes to thank the AIAA Executive Board and the "SHIP" for their continued financial support and encouragement for the continuation of this important public relations project.

RECOMMENDATIONS

This committee recommends:

(1) continued cooperation between the AIAA state representatives and the state associations to enable the teacher recognition program to continue.

(2) that certificates suitable for framing be prepared, printed and presented with the plaques starting with the 1969 convention.

(3) that these certificates be available to state associations for presentation to previous recipients 1963 through 1968, the state associations to purchase certificates from the National Office.

(4) that this committee incorporate an awards program to honor an individual in each state for outstanding service to his state association. The Teacher Recognition Committee will make recommendations at this annual meeting (1968).

Outstanding Industrial Arts Teacher Awards were presented to: James E. Ryan, Alabama Industrial Arts Association; James L. Perrill, Arizona Industrial Education Association; James Mansfield, Arkansas Industrial Arts Association; Albert B. Dyke, California Industrial Education Association; William Cloyd Johnston, Ontario Industrial Arts Association; Joel C. Davis, Colorado Industrial Arts Association; Werner R. Friess, Connecticut Industrial Arts Association; Herbert H. Hurst, Delaware Industrial Arts Association; Augustine E. Winnemore, District of Columbia Industrial Arts Teacher Association; Bruce M. Hamersley, Florida Industrial Arts Association; Lawrence M. Burke, Georgia Industrial Arts Association; George Schumann, Guam Industrial Education Association; Lee D. Carter, Idaho State Industrial Education Association; Robert E. Cochrane, Illinois Industrial Arts Round Tables; Dale Finney, Indiana Industrial Education Association; Allen A. Suby, Iowa Industrial Education Association; Keith Kirby, Kansas Industrial Education Association; Billie L. Evans, Kentucky Industrial Education Association; John E. Ball, Louisiana Industrial Arts Association; George S. Ange, Maine Industrial Arts Association; Alan Brown, Maryland Industrial Arts Association; John D. Loiko, Massachusetts Industrial Arts Association; Joseph Atwell, Michigan Industrial Education Society; John J. Jacobi, Minnesota Industrial Arts Association; Bobby S. Trussell, Mississippi Industrial Arts Association; Thomas A. Grim, Missouri Industrial Arts Association; John H. Giese, Montana Industrial Arts Association; Melvin D. Wattles, Nebraska Industrial Arts Association; Oliver J. Morgan, Nevada Industrial Arts Association; Carl M. Contois, New Hampshire Industrial Education Association; Charles Rolnick, New Jersey Industrial Arts Association; Horace W. Gambell, New Mexico Industrial Arts Association; Weldon Shepard, New York State Industrial Arts Association; Garlon O. Mann, North Carolina Industrial Arts Association; Ernest Breznay, North Dakota Industrial Arts Association; E. Eugene Rosenberger, Ohio Industrial Arts Association; Willie Bowman,

Oklahoma Industrial Arts Association; George R. Hobbs, Oregon Industrial Arts Association; Charles R. Schlegel, Pennsylvania Industrial Arts Association; Juan Cardona, Puerto Rico Industrial Arts Association; Stanley A. Andersen, Rhode Island Vocational and Industrial Arts Association (posthumously); Walter H. Rice, Jr., South Carolina Industrial Arts Association; David J. Fitz, South Dakota Industrial Arts Association; William T. Haston, Tennessee Industrial Arts Association; Thomas L. Bay, Jr., Texas Industrial Arts Association; Garth A. Hill, Utah Industrial Arts Association; Robert F. Harrington, Vermont Industrial Arts Association; Edward L. Daughtrey, Virginia Industrial Arts Association; Garland T. Brock, West Virginia Industrial Arts Association; Marshall T. Paulson, Wisconsin Industrial Arts Association; Jack W. Dinnel, Wyoming Industrial Arts Association.

RESOLUTIONS APPROVED BY THE DELEGATE ASSEMBLY

1. Appreciation to the President

WHEREAS Dr. Ralph C. Bohn has given unstintingly of his time and has provided capable and intelligent leadership as president of the American Industrial Arts Association, and

WHEREAS the American Industrial Arts Association has made notable progress under his direction,

THEREFORE BE IT RESOLVED that the officers, the Executive Board, and the members of the American Industrial Arts Association express sincere appreciation for his outstanding service as president of the association during the year 1967-1968.

2. Appreciation to the Program Participants

WHEREAS many members of the American Industrial Arts Association have given many hours of faithful service in making the effective plans and excellent preparations for the thirtieth annual convention in the upper-Midwest region, and

WHEREAS innumerable responsibilities were willingly accepted and capably completed by many persons working in the upper-Midwest region, and

WHEREAS a cordial environment, cooperative spirit, and friendly atmosphere characterized the convention,

THEREFORE BE IT RESOLVED that sincere appreciation be expressed to Sterling Peterson, general chairman; Dr. Robert S. Swanson, program chairman; Dr. Wesley Face, program co-chairman; Dr. George Ditlow, convention director; and to all of the industrial arts students, teachers, supervisors, and teacher educators, as well as to industrial arts student club members, whose generous contribution of time and effort insured the success of this convention.

3. Appreciation to the SHIP

WHEREAS the continued support and assistance of the SHIP is a significant factor in the conduct of the annual convention of the American Industrial Arts Association, and

WHEREAS the commercial exhibits do contribute in large measure to the spirit and substance of the convention,

THEREFORE BE IT RESOLVED that the members of the American Industrial Arts Association express their sincere appreciation to Eugene S. Bellezzo, president, and Daniel W. Irvin, vice-president, of the Educational Exhibitors Association, and to Deck Officer Robert J. Quinn and his crew, and to all the commercial exhibitors for their participation [illegible] the 196[illegible] convention.

4. Commendations for Teacher Recognition Program

WHEREAS the American Industrial Arts Association is pledged to encourage and recog[illegible] excellence in teaching, and

[illegible]EREAS the program for the recognition of outstanding teachers has come to be one of the highlights of the convention program,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express their appreciation and commendation to Vice-president

Sherwin D. Powell and his committee for the excellent conduct and continued promotion of this program.

BE IT FURTHER RESOLVED that expressions of appreciation and commendation be forwarded to the officers and members of the state associations who have participated in this program.

BE IT FURTHER RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to the SHIP organization for its continued financial support of this program to recognize outstanding classroom teachers.

5. Appreciation to Executive Secretary

WHEREAS the effective functioning of the national office is a vital factor in the promotion and improvement of industrial arts education, and

WHEREAS the coordination and administration of all phases of the program and services of the American Industrial Arts Association are the responsibility of the executive secretary and his staff,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express their sincere appreciation to Dr. Howard S. Decker for the very capable and efficient manner in which he has performed the duties of executive secretary-treasurer of the American Industrial Arts Association.

6. New Affiliates of the American Industrial Arts Association

WHEREAS Association affiliates aid significantly in furthering the program of the American Industrial Arts Association and in carrying its program to the membership, and

WHEREAS Association's petition for membership on a voluntary basis is an affirmation of interest and support for the program of the American Industrial Arts Association,

THEREFORE BE IT RESOLVED that affiliation membership be approved for the following associations, and their officers and members be commended for their actions in making this request:

Illinois Industrial Education Association
Louisiana Industrial Arts Association
Nebraska Industrial Education Association

7. WHEREAS the success of the convention was insured through the wholehearted cooperation of the Minneapolis Public Schools, and

WHEREAS the school system provided valuable support in personnel, equipment, and facilities,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to the Board of Education and the Administrative Staff of the Minneapolis Public Schools.

8. WHEREAS the Governor of the State of Minnesota has shown interest in and concern for Industrial Arts Education by proclaiming the week of April 30-May 3, 1968, as Industrial Arts Week in Minnesota,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express sincere gratitude to Governor Harold LeVander for this proclamation.

9. WHEREAS the total program of the American Industrial Arts Association convention is enriched and strengthened by the activities designed for the ladies in attendance, and

WHEREAS this year's program for the ladies provided many interesting features,

THEREFORE BE IT RESOLVED that the officers and members of the American Industrial Arts Association express appreciation to Mrs. Fran PaDelford and her committee for their program of Ladies' Hospitality.

10. Appreciation to the Educational Press Association

WHEREAS the American Industrial Arts Association is justly proud of its professional publication, The Journal of Industrial Arts Education, and

WHEREAS the publication was given two awards for "Excellence in Educational Journalism" in 1967 by the Educational Press Association of America,

THEREFORE BE IT RESOLVED that the American Industrial Arts Association accept these awards and express its appreciation to the Educational Press Association of America for this recognition.

11. Commendation to the American Association of School Administrators

WHEREAS the American Association of School Administrators in 1967 published the Curriculum Handbook for School Administrators and distributed copies to its membership, and

WHEREAS Chapter 7 of this publication is devoted to Industrial Arts Education,

THEREFORE BE IT RESOLVED that the American Industrial Arts Association express its appreciation and commendation to the American Association of School Administrators and its editors Drs. Forrest E. Conner and William J. Ellena.

12. State Supervision of Industrial Arts

WHEREAS, industry and technology have become the dominant element in American economic life; and

WHEREAS industrial arts is the area of education concerned with the interpretation and understanding of industry; and

WHEREAS many new educational techniques and media have become available, necessitating improved educational communications; and

WHEREAS leadership at the state level is essential to the growth and development of sound industrial arts programs in the public schools; and

WHEREAS state leadership is available in 33 of the 50 states, and there is a need for the extension of this service; and

WHEREAS those states with professional leadership in industrial arts in the state department of education tend to have better programs of industrial arts and serve more youth;

THEREFORE BE IT RESOLVED that the American Industrial Arts Association request Congress to support legislation that will provide the necessary leadership and ancillary services in industrial arts in all states; and

BE IT FURTHER RESOLVED that the American Industrial Arts Association seek the support of all interested groups and organizations in the enactment of this needed legislation.

13. WHEREAS Title III of the National Defense Education Act has provided funds for the purchase of equipment and instructional materials for the continued improvement of instruction in Industrial Arts in our nation; and

WHEREAS the Administration in Washington has recommended a drastic cutback in funds for Title III of NDEA;

BE IT RESOLVED that the Association recommend that the Congress of the United States appropriate the full authorization for this act.

14. WHEREAS it has been proposed in certain states that the professional standards for teacher certification be lowered; and

WHEREAS Industrial Arts has been one of the subject areas mentioned in these proposals;

BE IT RESOLVED that the Association re-affirm its position that one of the minimum requirements of an Industrial Arts teaching credential is the Baccalaureate degree.

15. WHEREAS Title XI of the National Defense Education Act has provided valuable inservice training to thousands of Industrial Arts teachers, supervisors and teacher educators; and

WHEREAS this act has been ably administered by the US Office of Education;

BE IT RESOLVED that the Association express its appreciation to the administrators of this title, Drs. Donald Bigelow and Paul R. Manchak.

PRESIDENT'S REPORT

Ralph C. Bohn

The American Industrial Arts Association enjoyed another year of growth, and continued to provide leadership for the improvement and development of industrial arts in the nation. Our Association is held in high esteem by the US Office of Education, the

National Education Association, and the numerous professional groups and individuals working with our national office.

High priority has been placed on the program of prompt and efficient service to the growing membership of the Association. Correspondence is answered promptly and membership applications and renewals processed on the day they arrive. Efforts have been made to improve communications between state representatives of the AIAA, state associations and the national office.

Last year, the state representatives and the membership committee, chaired by Harry Gunderson, embarked on a "Double the AIAA by 1970" campaign. This campaign has been met with enthusiastic response. By April 1, 1968, twenty states had already met their July, 1968 goal and eleven more were very close, and have probably met their goal at this time. As a result, the campaign is progressing at a rate which, if continued, will double our membership by 1970.

The full effect of the membership renewal system became apparent during the past year. In the past, we have had an annual dip in membership each January. This was when the members of the previous year were dropped if they had not renewed their membership. Since membership is now on a continuous basis – that is, a member is billed for renewal one year after he joined – the January dip has disappeared.

The accompanying graph shows the life and regular membership of the Association since July, 1962. As you can see, we passed our previous membership high at the 1967 convention in Philadelphia. Since that time membership has continued to increase at a fairly steady rate. Projected membership is shown through July, 1968. In addition to the 7000-8000 regular and life members, there are approximately 3000 retired, college student and sustaining members – providing a total membership of over 10,000. This figure doesn't include library, group or student club membership.

In August, 1967, our Association was awarded an NDEA Title XI Institute from surplus funds from the 1967 Institute program. This Institute was one of five experimental programs designed to evaluate new avenues of in-service education. Appalachian State University was designated as the fiscal agent and responsible university. Between August and January, five one-week Institutes were conducted – one each in Salt Lake City, Atlanta, New York, Tulsa and Chicago. The purpose of the Institutes was to acquaint officers of state associations with responsibilities they have towards the in-service education of teachers, and provide the necessary background to improve service to their members. The Institute was directed by Howard S. Decker. The staff included Erwin P. Bettinghaus, Associate Dean, College of Communication, Michigan State University, and Richard Miller, Director of the Curriculum Institute, University of Kentucky. Industrial arts staff and consultants included Earl M. Weber, Robert L. Woodward, Joseph A. Schad, Paul W. DeVore, Delmar W. Olson, Willis E. Ray, Eugene R. P. Flug, Fred D. Kagy, Joseph J. Carrel, and many additional leaders of the profession from all parts of the country. A total of 168 state association officers representing 49 of the 50 states and the Commonwealth of Puerto Rico attended.

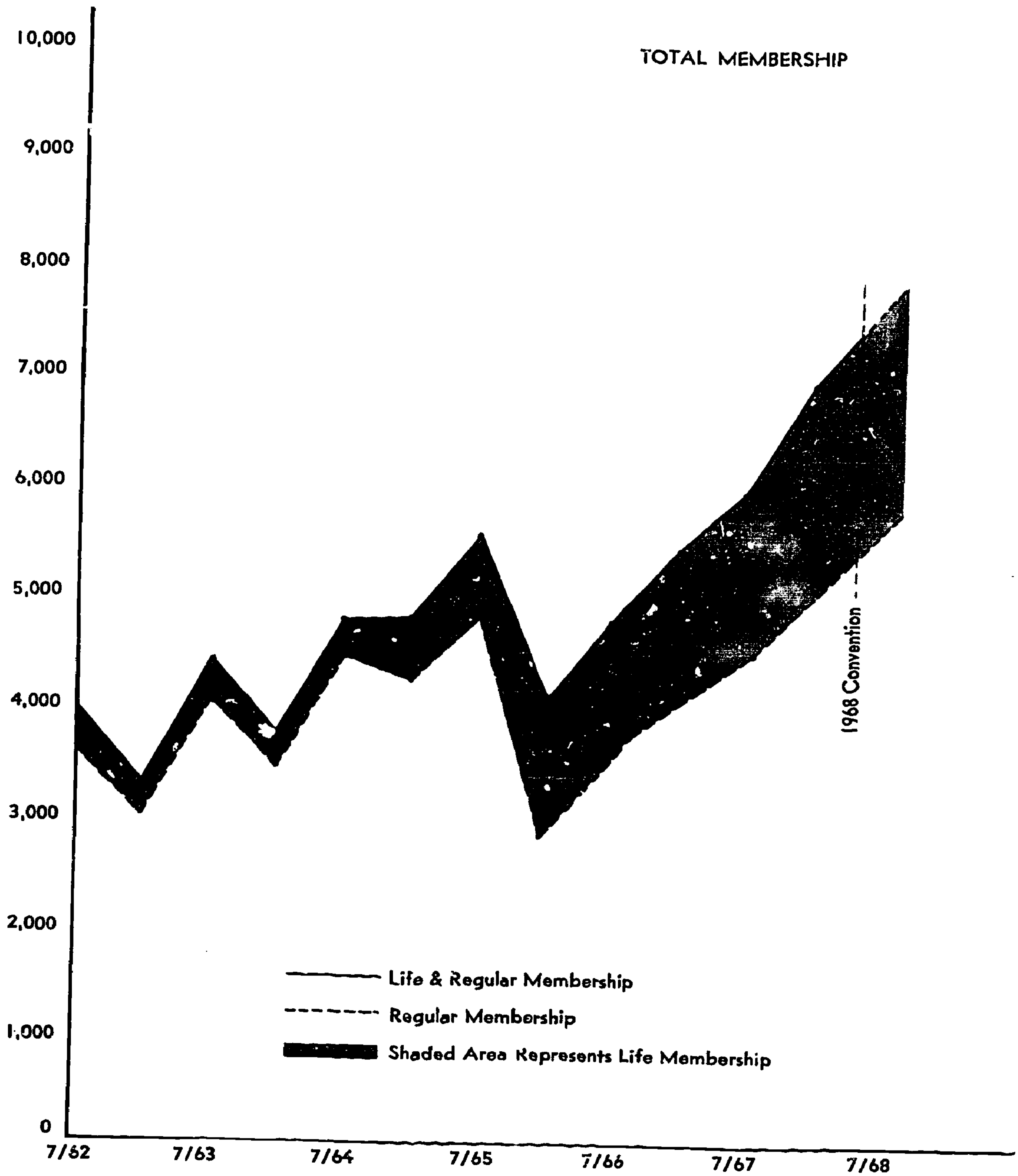
Since the Institute was experimental, a thorough evaluation was conducted and included with the final report. The success of this Institute may lead to similar programs for other associations, as well as a possible repeat for the AIAA.

Since last year's convention in Philadelphia, the AIAA has been actively involved in a wide variety of professional activities. These include:

(1) Accreditation. The American Association of Colleges of Teacher Education (AACTE) has continued with the revision of accreditation standards for teacher education. They have requested guidelines for industrial arts to be used in their pilot programs under their new guidelines. Howard F. Nelson, president of the American Council on Industrial Arts Teacher Education, is working with his association and accreditation committee to provide the needed guidelines.

Requests for accreditation standards for secondary school industrial arts have also been received, the most recent from North Central Accreditation Association. Our committee on Testing and Evaluation, chaired by Leonard Glismann, is developing these standards.

(2) Research. The Research Committee, chaired by William T. Sargent, has been working with the Education Retrieval Information Center (ERIC) of Ohio State University to expand their coverage of industrial arts. The Center has the responsibility of identifying industrial arts research, speeches and publications. This information is placed on microfilm and made available to individuals and groups on a cost basis.



TOTAL MEMBERSHIP
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
7/62
7/63
7/64
7/65
7/66
7/67
7/68
1968 Convention
Life & Regular Membership
Regular Membership
Shaded Area Represents Life Membership

In October, 1968, the Center at Ohio State will conduct a research conference in industrial arts education. The conference will have a dual goal – to identify needed research, and to obtain commitments for planning and conducting the needed research.

(3) Safety. During October, 1967, Denis J. Kigin, chairman of the Safety Committee, was our Association's delegate at the National Safety Congress held in Chicago. The committee is continuing its preparation of manuscripts for an industrial arts safety publication.

(4) Publications. The AIAA's supply of available publications is being sold at a rapid rate. The Publication Committee, under the chairmanship of Ronald L. Koble, is developing a long-range plan for the continued preparation and publication of professional materials for the Association.

(5) Student Clubs. This year the student club program of the AIAA was divided into two groups. The College Club Committee, chaired by Rex Miller, works with organized groups of college students. All members of this group are student members of the AIAA, since they are future industrial arts teachers.

The high school group, chaired by W. A. Mayfield, has been formed into a separate Association, with its own newspaper and dues structure. Industrial arts teachers should avail themselves of this opportunity to organize local high school industrial arts clubs, and have them join the national group.

(6) Professional Relations. Professional relations is a responsibility of all members of the Association, as well as an orga ized responsibility of the Professional Relations committee, chaired by Al ' A. Newton. During the year, numerous activities were conducted to maintain an' improve our relations with other groups and individuals. These include:

(a) The orientation meetings and receptions planned and hosted by the AIAA International Relations Committee, chaired by Donald E. Perry.

(b) The Industrial Arts Teacher Education Award program, which recognizes outstanding classroom teachers from all parts of the U.. ed States and Canada. Fifty-one awards were presented this year. This program is chaired by the vice president for classroom teachers, Sherwin D. Powell.

(c) Representation at the World Confederation of Organizations of the Teaching Profession in Vancouver; representation at the inauguration of five new presidents of colleges or universities; board membership on CONPASS (a Consortium of Learned Organizations); standardized test preparation through AIAA members working with the Educational Testing Service (ETS), Princeton, NJ; speeches by board members and the executive secretary at more than 50 state association conferences, colleges and universities, and local industrial arts groups, membership on the Education Product Information Exchange (EPIE) – are other methods whereby our association has attempted to develop and maintain public relations.

(7) The Sixteenth Yearbook of the American Council on Industrial Arts Teacher Education (ACIATE), titled Evaluation Guidelines, was provided for all members of the AIAA. All production costs were paid for by the teacher education council as a professional contribution to the growth and development of the profession.

The Journal of Industrial Arts Education has continued the high editorial and presentation standards under the editorship of Linda A. Taxis. Miss Taxis became acting managing editor this fall and was appointed Journal managing editor at this convention board meeting. During the past year, The Journal received two Education Press Awards, one of the few professional journals to be so honored.

The AIAA packet service again included a special mailing of NDEA Title XI Institute Brochures to all members in Januar Three other packet mailings of educational materials were sent to all members. The AIAA packet service is financed by the companies and groups providing information for the packet. No AIAA funds are used for this service.

The Read-Out, the AIAA newspaper, will be published twice during the current year. The first issue was sent to all members in December and included a listing of Industrial Arts Institutes. It was placed in the mail the day after the Institute list was released in Washington. The second issue of the Read-Out will be published after the convention.

The Association's legislative program, led by John O. Conaway, chairman of the Legislative Information Committee, has worked for increased appropriations for the bills which have aided industrial arts. The passage of the Education Profession's Development Act, supported by our Association, has produced a major reorganization and expansion

of the in-service education activities of the US Office of Education. The national office has kept state, collegiate and local IA leaders appraised of the development of this bill by providing them with proposal guidelines, as well as with the information on federal legislation.

Under the able guidance of our convention director, George H. Ditlow, a program of planning and selecting convention sites five years in advance has been developed. This lead time is needed to assure reserving the facilities needed to conduct the convention. Future convention sites include (a) 1969 - Las Vegas, April 7-11, (b) 1970 - Louisville, (c) 1971 - Miami. Convention sites for 1972, '73, and '74 will be considered at the summer board meeting, thereby placing us on the five-year-in-advance schedule.

This summer, a special NDEA Title XI Institute for State Supervisors of Industrial Arts, will be conducted in Washington, DC. The Institute is being conducted by the University of Miami. Our association is assisting through the cooperation of the American Council of Industrial Arts Supervisors.

During the past year, it became apparent that the scope and breadth of industrial arts had to be defined in a clear and concise manner. In order to investigate this need, a special commission chaired by Theodore Guth was appointed to meet at this convention. Their work will be continued this August when the Association sponsors a curriculum symposium prior to the Supervisors' Institute. The symposium will involve both industrial arts personnel and representatives from government and other disciplines. The objectives are: (1) to explore the full potential of industrial arts education, and (2) to develop a policy concerning the relationship of industrial arts to the growing occupational education needs of the public schools, the role of industrial arts in the inner-city schools, and the changing structure of industrial arts in public education. Financial support for the conference is coming from both federal and industrial groups. It is hoped that this conference will help plot the future direction of our profession.

The officers of the association continue to look for additional ways to assist the growth and improvement of industrial arts education. Short public relations films and longer teacher recruitment and guidance films are needed by the profession. Ways to finance these films are being actively sought. These include the development of a special Professional Projects fund and the presentation of proposals to public and private funding groups. The preparation of high quality films is expensive but needed to present industrial arts to the public.

Consideration is being given to expanding The Journal of Industrial Arts Education to a monthly publication, during the school year. This is a needed service and one which will provide improved communications to all members. The added expense may require a modest dues increase, needed to pay for added issues of The Journal, plus the rising costs of maintaining a national office.

The increased membership of the past year has permitted the Association to replace money used from our Reserve Accounts, and develop a firm financial foundation for the future growth of the Association.

This report is already more lengthy than it should be. Yet, it has not given adequate recognition to the hard-working committee chairmen, committee members, board members, national office staff and the members of the Association, who continue to support industrial arts by maintaining active membership and support of the American Industrial Arts Association.

I have been especially pleased to be associated with Howard Decker, our executive secretary. He is providing the highest possible level of professional leadership and is guiding our Association to a true position of leadership in industrial arts education.

In closing, I would like to mention that I have thoroughly enjoyed my year as President of the Association. I have enjoyed the opportunity to meet and discuss industrial arts with teachers, supervisors and teacher educators from all parts of the country. These contacts have increased my respect for the present and potential program of education provided by industrial arts for the youth of our nation. Our future is bright.

Dr. Bohn is President of the AIAA and chairman of the Industrial Arts Department, San Jose State College, San Jose, California.

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